CHAPTER 3—AFFECTED ENVIRONMENT

3.1 PROJECT AREA OVERVIEW

3.1.1 Geographic Setting

The Planning Area for the Moab Master Leasing Plan (MLP) includes a portion of Bureau of Land Management (BLM)-administered public lands and Federal mineral estates managed by the BLM's Moab Field Office in Grand County and San Juan County, and a smaller area of BLM-administered public lands managed by the Monticello Field Office in San Juan County (Map 3-1). The Planning Area is located in the Colorado Plateau physiographic province. It includes about 946,469 acres of land in east-central Utah south of Interstate 70. The area adjoins the town of Moab and Arches National Park. The western boundary is the Green River and the northeastern boundary of Canyonlands National Park. To the south of Moab, the eastern boundary is United States (U.S.) Highway 191. This area encompasses a mix of land use including developed and dispersed recreation, limited oil and gas development, and a potash facility on private land. Table 3-1 shows the private, State, and other Federal land ownership within the Planning Area.

Table 3-1. Land Ownership within the Planning Area

Land Status	Moab Field Office Acres	Monticello Field Office Acres	Planning Area Total Acres
BLM	581,624	203,943	785,567
State	91,805	32,490	124,295
State Parks	4,337	40	4,377
Private	17,855	14,375	32,230
Split Estate	9,855	5,281	15,136
Total Planning Area Acreage*	**695,621**	**250,848**	**946,469**

*Acreage not additive
Source: BLM Canyon Country District.

The Planning Area experiences wide temperature variations between seasons and climate varies widely with altitude. In the higher elevations, precipitation comes in the form of snow, with large accumulations in the late fall and winter. Snowmelt in the higher elevations is generally complete by mid to late June. Afternoon thunderstorms, often resulting in flash flooding, are common from late spring through early fall. Summer high temperatures in the upper elevations often reach 85 °F, with lows in the 50s. Lower elevation high temperatures can reach over 100 °F. Winters are cold, with highs averaging 30 °F to 50 °F, and lows averaging 0 °F to 20 °F.

The average annual precipitation of the northern section of the Planning Area is 9.2 inches, most of which comes in the form of late spring rains and fall thunderstorms. Dry air, high elevations (4,000 to 6,000 feet), and winter snowfall combine to create a cold desert climate. Maximum summer temperatures hover in the high 90s, cooling off to the low 60s at night. Winter high temperatures are generally in the high 30s, with nighttime temperatures dipping into the low teens.

The middle section of the Planning Area (near Moab) receives an average of 9.0 inches of precipitation per year, most of which comes in the form of late spring rains and fall and winter snows. Maximum summer temperatures average 95 °F. Winter high temperatures average 50 °F, and lows average 21 °F.

The southern section of the Planning Area (near Monticello, just south of the Planning Area boundary) receives an average of 15.2 inches of precipitation annually; most of this comes in late summer thunderstorms and fall snows, which can leave heavy accumulations in the higher elevations. Maximum summer temperatures average in the 80s °F during the day and low 50s °F at night. Winter high temperatures average 40 °F, with nighttime temperatures averaging 16 °F.

Across the Planning Area, summer precipitation is often in the form of short, intermittent thunderstorms, while winter precipitation results in accumulated snow pack that infiltrates the soil and recharges the aquifers. Air temperature and precipitation data collected from 1889 through 2003 for four locations in the Planning Area are displayed in Table 3-2 and Table 3-3 (WRCC 2004). Table 3-4 displays data for Moab and Natural Bridges National Monument up to 2005 for monthly averages on temperature, precipitation, snowfall, and snow depth. Table 3-5 contains average wind speed and prevailing wind direction by month for Moab Canyonlands and Bryce Canyon National Park. Peak elevation temperature and precipitation information was not available.

Table 3-2. Temperature Data for Four Locations in the Region

Station	General Location	Elevation (Feet)	Summer Means		Winter Means		Extremes	
			High	Low	High	Low	High	Low
Thompson	North of Planning Area boundary	6,100	90.1	60.2	40.9	17.8	110.0	-25.0
Moab	Middle portion of Planning Area	4,025	95.3	59.9	45.9	20.9	114.0	-24.0
La Sal	Southern portion of Planning Area	6,990	80.7	51.9	37.6	14.7	91	-27.0
Monticello	Just South of Planning Area Boundary	7,070	81.5	50.0	37.9	16.1	101	-22.0

Note: Temperature in ºF.

Table 3-3. Precipitation Data for Four Locations in the Region

Station	Mean				Annual		
	Winter	Spring	Summer	Fall	Mean	High	Low
Thompson	2.0	2.3	2.2	2.7	9.2	19.96	2.0
Moab	2.0	2.4	2.1	2.6	9.0	16.4	4.3
La Sal	2.7	2.7	3.8	3.7	12.8	24.8	6.5
Monticello	3.9	2.9	4.0	4.4	15.2	23.1	6.6

Note: Precipitation in inches.

Table 3-4. Monthly Climate Summary for Moab* and Natural Bridges National Monument**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Moab													
Ave. Max. Temp. (°F)	42.4	50.8	62.1	72.1	82.2	92.5	98.1	95.2	86.6	73.4	56.9	44.4	71.4
Ave. Min. Temp. (°F)	18.2	24.6	32.8	40.8	48.5	56.0	62.8	61.0	51.5	39.5	28.2	20.3	40.3
Ave. Total Precip. (in.)	0.67	0.61	0.83	0.81	0.72	0.43	0.78	0.86	0.85	1.01	0.70	0.75	9.0
Ave. Total Snowfall (in.)	3.9	1.5	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.8	9.8
Ave. Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Bridges National Monument													
Ave. Max. Temp. (°F)	40.1	44.7	52.0	61.2	72.5	83.7	89.4	86.2	77.4	64.6	49.7	40.7	63.5
Ave. Min. Temp. (°F)	18.8	22.9	28.5	34.0	43.4	52.5	59.2	57.3	49.8	38.8	28.0	19.6	37.7
Ave. Total Precip. (in.)	1.01	0.83	1.16	0.83	0.72	0.46	1.33	1.56	1.33	1.38	1.01	0.91	12.5
Ave. Total Snowfall (in.)	10.6	6.0	6.0	2.7	0.2	0.0	0.0	0.0	0.0	0.7	4.2	9.6	40.0
Ave. Snow Depth (in.)	4	3	1	0	0	0	0	0	0	0	0	2	1

From Western Regional Climate Center.
*Moab (425733) (1/1/1890 to 12/31/2005)
**Natural Bridges National Monument (426053) (6/17/1965 to 12/31/2005)

Table 3-5. Average Wind Speed and Prevailing Wind Direction

Station	Average Wind Speed (MPH)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Moab-Canyonlands AP ASOS (1998-2006)	4.0	5.2	6.9	9.2	8.9	8.7	7.2	6.8	6.3	5.4	4.4	3.7	6.3
Moab - Canyonlands AP	NW	W	W	W	W	SW	SE	E	W	W	W	NW	W
Bryce Canyon AP ASOS (2000-2006)	8.0	8.5	9.0	10.4	9.6	9.8	8.2	8.0	8.7	8.2	7.9	7.5	8.6

Station	Average Wind Speed (MPH)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Bryce Canyon AP, UT	W	W	W	W	W	W	W	W	W	W	W	W	W

From Western Regional Climate Center.

Public lands within the Planning Area include about 785,567 acres. Approximately 581,624 acres (61 percent of the Planning Area) are managed by the Moab Field Office and 203,943 acres (22 percent of the Planning Area) are managed by the Monticello Field Office. About 13 percent of the land in the Planning Area consists of State Trust Lands, administered by the Utah School and Institutional Trust Lands Administration (SITLA). Land ownership in the Planning Area is depicted in Table 3-1. Privately-owned lands are concentrated primarily around the major transportation routes and river corridors. The Planning Area has a high potential for the development of oil, gas, and potash resources and the interest in the leasing of these resources is great. The BLM has received recent Expressions of Interest to lease over 120,000 acres for oil and gas. Additionally, the BLM has received 223 potash prospecting permit applications (PPA) covering 416,614 acres.

The Planning Area has some of the most iconic scenery on the Colorado Plateau. The Planning Area contains lands identified by the BLM as having outstanding visual resources, high value recreation areas, lands with wilderness characteristics, and high quality air resources. More than two million visitors a year enjoy a wide variety of recreational experiences within the Planning Area. The Planning Area also includes six Areas of Critical Environmental Concern (ACEC), six Special Recreation Management Areas (SRMA), portions of the Old Spanish National Historic Trail (OSNHT), and two suitable Wild and Scenic Rivers (WSR) (the Colorado River and the Green River).

3.2 AIR QUALITY

3.2.1 Introduction

The BLM's air resources program includes climate and air quality. Climate includes assessment of existing climate, a qualitative description of climate change, and analysis of potential effects of climate change on BLM resources. Air quality includes air quality management, inter-agency coordination, smoke abatement for prescribed fire, and air quality impact assessment. The BLM is responsible for considering and incorporating climate and air quality into multiple-use programs, for managing the public lands in a manner which will protect air quality, and complying with applicable laws, statutes, regulations, standards, and/or implementation plans.

3.2.2 Existing Air Quality

The Environmental Protection Agency (EPA) has set National Ambient Air Quality Standards (NAAQS) for criteria pollutants which include both Primary and Secondary Standards (Table 3-6).

- Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly.

- Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

Table 3-6. National Ambient Air Quality Standards

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		Primary and secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and secondary	Annual	53 ppb (2)	Annual mean
Ozone [80 FR 65292, Oct 26, 2015]		Primary and secondary	8-hour	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	Primary and secondary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
			24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		Primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Pollutant [final rule cite]	Primary/ Secondary	Averaging Time	Level	Form
	secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

[1] Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[2] The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
[3] Final Rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place.
[4] Final Rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

The NAAQS apply to six pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), and particulates whose diameter are smaller than ten µm (PM_{10}) or smaller than 2.5 µm ($PM_{2.5}$). Table 3-7 provides the various emissions of the six pollutants by source sector. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air ($\mu g/m^3$).

Currently, air quality is good within the Planning Area; however, because the EPA and Utah Division of Environmental Quality (UDEQ) are continually reassessing air quality standards, compliance may be harder to achieve in the future, thereby making constant and effective planning and management for the control of specific project pollutant emissions more challenging.

Additional issues focus on mobile source emissions specific to visitation and traffic within the Planning Area. Current Easter weekend visitation in the Moab area is greater than 20,000 visitors. Many recreational visitors engage in motorized activities that represent emission sources in addition to the highway vehicles utilized for transportation. There are about one million visitors annually to the Planning Area.

Table 3-7. 2008 Criteria Pollutant Inventory (tons per year)

County	Source	CO	NOx	PM10	PM2.5	SOx	VOC
Grand	Area Source	7,810.05	653.96	1,335.06	198.70	4.67	1,481.13
	Non-Road	2,712.31	246.88	37.71	34.76	15.82	953.33
	On-Road Mobile	3,706.00	1,528.00	379.54	137.62	4.40	288.47
	Point Source	153.22	394.54	41.95	41.64	1.87	55.58
	Biogenics	7,462.91	292.62	0.00	0.00	0.00	34,422.40
	Wildfires	304.49	8.67	36.84	33.16	0.00	52.01
	Total	**22,148.98**	**3,124.67**	**1,831.09**	**445.87**	**26.76**	**37,252.92**
San Juan	Area Source	16,472.72	923.15	5,988.30	745.33	15.77	12,103.59
	Non-Road	1,622.93	110.85	17.86	16.69	0.61	487.84
	On-Road Mobile	2,386.00	993.80	498.66	153.02	3.69	208.97
	Point Source	153.32	395.63	168.68	37.24	33.32	56.34
	Biogenics	15,795.80	628.15	0.00	0.00	0.00	72,896.60

County	Source	CO	NOx	PM10	PM2.5	SOx	VOC
	Wildfires	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**36,430.76**	**3,051.58**	**6,673.49**	**952.28**	**53.40**	**85,753.34**

Source: UDEQ 2011

Mobile sources (primarily motor vehicles) account for most of the CO, NOx, and a large amount of the PM in the Planning Area. Biogenics are the dominant source of Volatile Organic Compounds (VOC). Various minor area sources contribute the remainder of the emission.

Prescribed fire and naturally caused fires occur within the Planning Area. Prescribed burning is a useful tool for resource management and may be used to achieve a variety of objectives such as restoring a fire-dependent ecosystem, enhancing forage for cattle, improving wildlife habitat, preparing sites for reforestation, or reducing hazardous fuel loads. Fire, for any of these reasons, will produce smoke and other air pollutants. Some short-term air pollutant releases are necessary to achieve the many benefits of prescribed burning. Short-term effects on air quality from prescribed burns include a general increase in particulate matter, CO_2, and O_3 precursor emissions. Land managers recognize that smoke management is critical to avoid air quality intrusions over sensitive areas or visibility problems. Vegetation management is an active part of fire management techniques and long-term effects of prescribed burning include a reduction in particulate matter, CO_2 and O_3 precursor emissions specific to wildfire in unmanaged areas. As a result of careful management, there is usually less smoke from a prescribed fire than from a wildfire burning over the same area.

The Canyon County District has existing sources of air pollution that emit O_3 precursor gases and particulate matter - the two primary pollutants of concern in the Planning Area. O_3 is a regional problem typical in the western states as precursor gases (nitrogen oxides and volatile organic compounds) from wildland fires, transport from shipping lanes, electric power generation, oil and gas production, and a conglomerate of other sources combine under certain meteorological conditions to form O_3.

Particulate matter is composed of both coarse particles (e.g., windblown sand, road dust, etc.), and fine particulate (PM_{10} and $PM_{2.5}$) which can be both directly emitted and secondarily formed as aerosols under certain meteorological conditions. Fine particulate is of greater concern as it is a regulated air pollutant with clearly defined health impacts. Particulate can also be deposited on vegetation and snow packs with potential environmental issues. Both O_3 and particulate can be transported great distances and are generally recognized as regional issues in the southwest, although elevated short-term concentrations occur due to surface-disturbing activities and/or wind events.

National Ambient Air Quality Standards

Data collected from a recent assessment of air quality in National Parks around the country found that O_3 concentrations have remained under the NAAQS and are similar across the entire western region (Table 3-8 and Table 3-9).

Table 3-8. Monitoring Locations with 3-Year Average 4th-Highest 8-Hour Ozone Concentration Greater Than or Equal to 60 ppb (2008)

Park	3-Year Average 4th-Highest 8-Hour Ozone Concentration (ppb)
Canyonlands National Park	71
Grand Canyon National Park	70
Great Basin National Park	72

Park	3-Year Average 4th-Highest 8-Hour Ozone Concentration (ppb)
Mesa Verde National Park	71
Yellowstone National Park	66
Zion National Park	71

Source: National Park Service, Air Quality in National Parks, 2009 Annual Performance and Progress Report (2010).

Table 3-9. Long-term Trends in Annual 4th-Highest 8-Hour Daily Maximum Ozone Concentration (2008)

Park	Slope (ppb/year)	P-value	Number of Valid Years	First Year of Data	Last Year of Data
Canyonlands National Park	0.32	0.18	16	1993	2008
Grand Canyon National Park	0.00	0.48	16	1993	2008
Great Basin National Park	0.17	0.22	15	1994	2008
Mesa Verde National Park	0.50	0.04(1)	14	1994	2008
Yellowstone National Park	-0.05	0.27	12	1997	2008

(1) Mesa Verde Degrading air quality trend, statistically significant ($p \leq 0.05$))
Source: National Park Service, Air Quality in National Parks, 2009 Annual Performance and Progress Report (2010).

O3 concentrations across the western states (including in Class I areas) often approach the current NAAQS level, and in some cases, have recorded monitored exceedances of the recently revised ozone NAAQS. Exceedances of the new 0.070 ppm ozone NAAQS have also been monitored at the National Park Service (NPS) Canyonlands monitoring site. Although the exact sources contributing to the high O3 concentrations across the region are not completely known at this time, studies indicate that regional oil and gas development activities may contribute to the rise in O3 concentrations in production areas (Katzenstein et al. 2003).

Fine particulate concentrations are not directly monitored in the Planning Area, however the National Park Service operates an Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring site at Canyonlands National Park which measures $PM_{2.5}$ concentrations to determine their contribution to visibility reduction in the park. Based on a review of particulate mass concentrations monitored at the IMPROVE site, $PM_{2.5}$ concentrations in the Planning Area are well under the applicable NAAQS concentrations both for the 24-hour standard and the annual standard.

No other measurement records of NAAQS pollutants exist for the Planning Area, and it can be assumed that concentrations are below applicable NAAQS. The entire Planning Area is designated as attainment or unclassifiable by the EPA, which means the area meets the NAAQS or insufficient data exists to make a determination of attainment status and the area is regulated as an attainment area under the Clean Air Act (CAA).

Visibility

Visibility is "the clarity with which distant objects are perceived" and is affected by pollutant concentrations, plume impairment, regional haze, relative humidity, sunlight, and cloud characteristics (EPA 2001). Visibility can be expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as a change in visibility that is just perceptible to an average person, about a ten percent change in light extinction. To estimate potential visibility impairment, monitored

aerosol concentrations are used to reconstruct visibility conditions for each day monitored. These daily values are then ranked from clearest to haziest and divided into three categories to indicate the Mean visibility for all days (Average); the 20 percent of days with the clearest visibility (20 percent clearest); and the 20 percent of days with the worst visibility (20 percent haziest).

IMPROVE monitoring data indicates the most visibility-impaired days in Canyonlands National Park exhibit visual distances between 61 and 80 miles and show improvements over the decade of 1998 to 2008 of approximately 35 percent. The mid-range days have visual distances of 78 to 109 miles and show no significant change. The least-impaired days have visibility ranges from 107 to 144 and also demonstrate improvements over the decade of approximately 25 percent (EPA 2003).

The visibility trend data from 1990 to 2008 are available from EPA for the Canyonlands National Park. A more recent assessment of visibility in the Canyonlands National Park indicates that the improvement trend in visibility has continued through 2008. While some visibility impairments are the result of natural sources such as windblown dust and soot from wildfires, which cannot be controlled; manmade sources of pollution can also impair visibility. These include motor vehicles (organic carbon), electric utility and industrial fuel burning (sulfates and particulate), and manufacturing operations (sulfates and fine particulate matter). Visibility in Canyonlands National Park is most influenced by sulfates, fine particulate matter (i.e., dust), and organic carbon. The visibility improvements seen over the past decade are the result of implementing State and Federal stationary and mobile source regulations.

The NPS calculates 10 year trends using a non-parametric regression technique called the Theil method to determine statistically significant trends of ozone, wet deposition, and visibility. Trends are considered statistically significant if they have at least 90% probability of being correct (those with p-values ≤ 0.10). Statistically significant (p-value ≤ 0.10) trends with zero slope or sites with no statistically significant trend are considered to remain unchanged.

While long term (1991-2013) trends at Canyonlands show statistically significant improvement (a slope of -0.12 dv per year improvement on the 20% best days and a slope of-0.08 dv per year improvement on the 20% worst days), the most recent 10 year period indicates that this improving trend has not been maintained. While both the long term and 10-year trends are of interest, the NPS uses the 10-year trends for tracking air quality conditions in parks. In part, this is because recent changes are important when evaluating continued progress towards visibility goals, particularly for parks where changes in emissions, industry, and/or development are occurring in the region, such as Canyonlands.

Table 3-10 below, provides long-term trends in annual deciview on clearest and haziest days. All parks indicated a statistically significant improving air quality trend on the clearest days (p </= 0.05), and Canyonlands also indicated an improving air quality trend on the haziest days.

Table 3-10. Long-term Trends in Annual Deciview (dv) on Clearest and Haziest Days

Park	Clearest Days		Haziest Days		Number of Valid Years	First Year of Data	Last Year of Data
	Slope (dv/year)	P-value	Slope (dv/year)	P-value			
Bryce Canyon National Park	-0.10	<0.01	0.03	0.11	18	1990	2008
Canyonlands National Park	-0.16	<0.01	-0.10	<0.01	19	1990	2008
Great Basin National Park	-0.15	<0.01	0.04	0.23	16	1993	2008

Park	Clearest Days		Haziest Days		Number of Valid Years	First Year of Data	Last Year of Data
	Slope (dv/year)	P-value	Slope (dv/year)	P-value			
Mesa Verde National Park	-0.08	<0.01	0.02	0.44	18	1989	2008
Yellowstone National Park	-0.10	<0.01	0.16	0.22	11	1997	2008

Source: National Park Service, Air Quality in National Parks, 2009 Annual Performance and Progress Report (2010).

Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and is reported as the mass of material deposited on an area (kilogram per hectare) per year. Atmospheric deposition can cause acidification of lakes and streams. One expression of lake acidification is change in acid neutralizing capacity (ANC), the lake's capacity to resist acidification from atmospheric deposition. ANC is expressed in units of micro-equivalents per liter (μeq/l).

Wet deposition refers to air pollutants deposited by precipitation, such as rain and snow. One expression of wet deposition is precipitation pH, a measure of the acidity or alkalinity of the precipitation. There are five National Atmospheric Deposition Program (NADP) stations in Utah: Logan, Murphy Ridge, Green River, Bryce Canyon National Park and Canyonlands National Park. The NADP stations in Bryce Canyon National Park and Canyonlands National Park have assessed precipitation chemistry since 1985 and 1997.

Dry deposition refers to the transfer of airborne gaseous and particulate material from the atmosphere to the Earth's surface. The Clean Air Status and Trends network (CASTNet) has measured dry deposition of SO_2, nitric acid (HNO_3), sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4), as well as various chemical species including O_3 in the U.S. since the late 1980s. There is one CASTNet station in Utah at Canyonlands National Park. Total deposition refers to the sum of airborne material transferred to the Earth's surface by both wet and dry deposition. Total nitrogen deposition is calculated by summing the nitrogen portion of wet and dry deposition of nitrogen compounds, and total sulfur deposition is calculated by summing the sulfur portion of wet and dry deposition of sulfur compounds. Total deposition has been measured at Canyonlands National Park (see Figure 3-1) from 1995 through 2009 (NPS 2010). Total nitrogen deposition has ranged from 1.7 to 2.2 kg/hectare-year since 1996.

Table 3-11 provides long-term trends in wet-deposition concentration. Bryce Canyon and Canyonlands National Parks indicated a statistically significant degrading air quality trend for ammonium concentrations, while Bryce Canyon, Grand Canyon, Great Basin, and Mesa Verde all indicated a statistically significant improving air quality trend for sulfate concentrations.

Table 3-11. Long-term Trends in Wet-deposition Concentration

Park	Ammonium		Nitrate		Sulfate		Number of Valid Years	First Year of Data	Last Year of Data
	Slope (meq/ liter/yr)	P-value	Slope (meq/ liter/yr)	P-value	Slope (meq/ liter/yr)	P-value			
Bryce Canyon National Park	0.33	0.04	-0.13	0.14	-0.42	<0.01	14	1989	2008
Canyonlands National Park	0.64	0.02	0.05	0.43	-0.05	0.36	10	1998	2008

Park	Ammonium		Nitrate		Sulfate		Number of Valid Years	First Year of Data	Last Year of Data
	Slope (meq/ liter/yr)	P-value	Slope (meq/ liter/yr)	P-value	Slope (meq/ liter/yr)	P-value			
Grand Canyon National Park	0.15	0.10	-0.03	0.45	-0.18	0.05	16	1989	2008
Great Basin National Park	0.13	0.30	-0.24	0.08	-0.26	<0.01	13	1990	2008
Mesa Verde National Park	0.16	0.05	0.06	0.31	-0.58	<0.01	19	1990	2008
Yellowstone National Park	0.20	<0.01	-0.00	0.45	-0.12	0.07	19	1989	2008

Source: National Park Service, Air Quality in National Parks, 2009 Annual Performance and Progress Report (2010).

Figure 3-1. Critical Load in North American Deserts Ecoregion.

Indicators used to evaluate the response of herbaceous plants to nitrogen deposition include changes in native and invasive grass and forb biomass, changes in plant water use and changes in mycorrhizal fungi community structure. Minimum: 3.0 kg/ha/yr, Maximum: 8.4 kg/ha/yr. (NPS 2014)

Hazardous Air Pollutants

Hazardous Air Pollutants (HAP) are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental impacts. The EPA has classified

187 air pollutants as HAPs. Examples of HAPs associated with oil and gas industry include formaldehyde, benzene, toluene, ethyl benzene, isomers of xylene (BTEX) compounds, and normal-hexane (n-hexane).

The CAA requires the EPA to regulate emissions of toxic air pollutants from a published list of industrial sources referred to as "source categories." The EPA has developed a list of source categories that must meet control technology requirements for these toxic air pollutants. Under Section 112(d) of the CAA, the EPA is required to develop regulations establishing national emission standards for hazardous air pollutants (NESHAP) for all industries that emit one or more of the pollutants in major source quantities. These standards are established to reflect the maximum degree of reduction in HAP emissions through application of maximum achievable control technology (MACT). Source categories for which MACT standards have been implemented include oil and natural gas production and natural gas transmission and storage.

Existing sources of HAPs within the Planning Area include (1) fossil fuel combustion that emits HAPs, such as formaldehyde, and (2) oil and gas operations that emit VOCs and may emit hydrogen sulfide (H_2S).

Climate Change

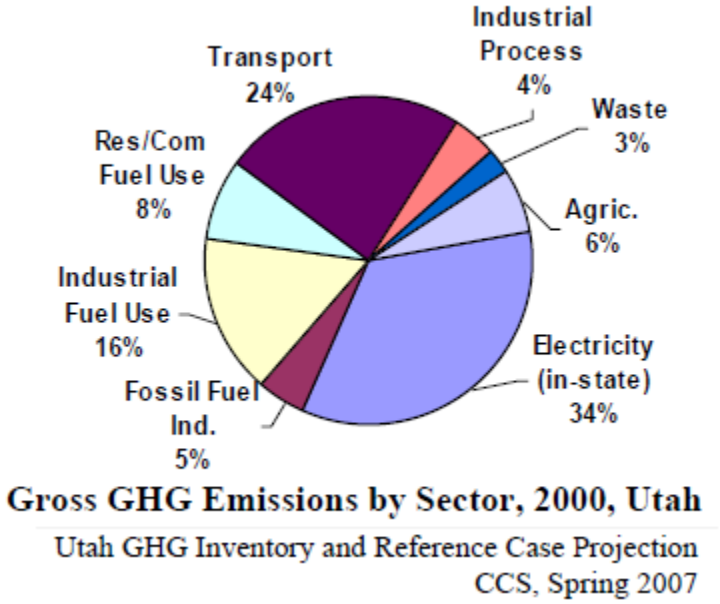
Ongoing scientific research has identified potential impacts of increased concentrations of certain gases on regional and global climate. These gases are commonly referred to as greenhouse gases (GHG) and include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), water vapor, and other trace gases. Through complex interactions on a regional and global scale, these emissions cause a net warming effect, primarily by decreasing the amount of heat energy radiated by Earth back into space. The fact surrounding GHGs and unequivocal warming is due to the gases absorption of long wave and infrared radiation. The GHG molecules absorb this outgoing radiation and allow for the earth energy balance to be altered. Although concentrations and emissions of GHGs have varied for millennia (along with corresponding variations in climatic conditions), population growth, industrialization, burning of fossil carbon sources, and other factors have caused GHG concentrations to increase substantially and contribute to overall climatic changes, typically referred to as global warming or climate change. Global atmospheric concentrations of CO_2, CH_4, and N_2O, have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years (IPCC 2007a). In light of the difficulties in attributing specific climate change impacts to any given local project or activity, projected GHG emissions can serve as a proxy for a proposed action's climate change impacts.

Some GHGs, such as CO_2, occur naturally and are emitted into the atmosphere through both natural processes and human activities. The GHGs that enter the atmosphere solely from human activities include:

- CO_2 from the burning of fossil fuels, solid waste, and trees and wood products.
- CH_4 emitted during the production and transport of coal, natural gas, and oil, and by livestock, deforestation, and agricultural practices.
- N_2O from agricultural and industrial activities and the combustion of fossil fuels and solid waste.
- Fluorinated gases that result from a variety of industrial processes (IPCC 2007a).

Figure 3-2 shows emissions by sector for the State of Utah. The document is an inventory of sources as received and reported to the EPA in the latest summary and projection report.

Figure 3-2. Emissions by Sector for the State of Utah



Secretarial Order 3289 directs the BLM to address the impacts of climate change on America's water, land, and other resources. The Council on Environmental Quality (CEQ) is developing guidance on addressing climate change in environmental analysis documents for Federal agencies, which will help the BLM (and other agencies) address climate change in National Environmental Policy Act (NEPA) documents. In December 2014 CEQ released draft guidance on addressing climate change in NEPA documents (79 FR 77801).

Indicators

The primary indicators of local contributions to climate change are GHG emissions in the Planning Area. Most GHG emissions in the Planning Area, primarily in the form of CO_2, result from the combustion of fossil fuels for energy use (IPCC 2007a). Energy demand is driven by population growth, economic development, traffic in main travel corridors (e.g., Interstate 15), and seasonal weather conditions. Other activities potentially contributing to CO_2 emissions include emissions from prescribed burning and wildfires. CH_4 emissions result from landfills, the development of fossil fuel resources (coal mines, and oil and gas drilling and production operations), and agricultural and livestock activities.

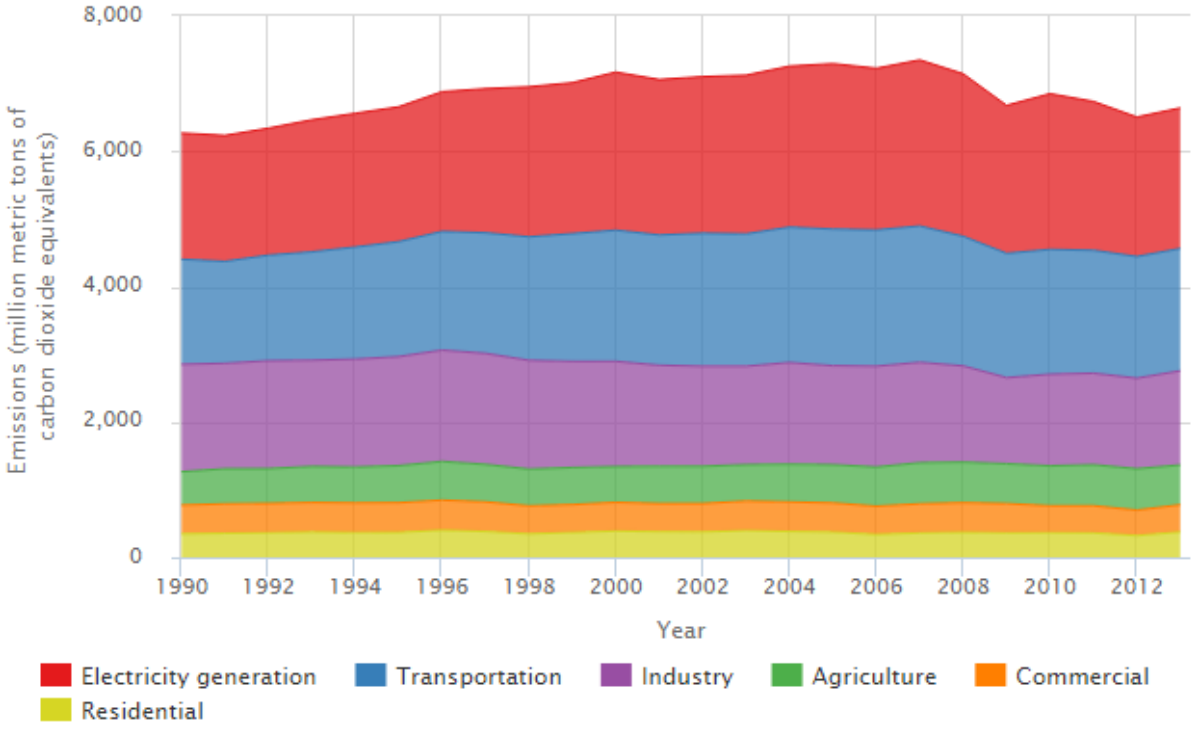
Potential indicators of stress on the environment that could result from climate change include changes to historical climatic patterns (climate, precipitation, extreme weather events); decreased water supply and stream flows; increased frequency and severity of wildfire, insect infestations, shifts in vegetation communities, flooding, and drought; decreased agricultural production; and decreased or degraded resource use opportunities (e.g., recreation).

Although naturally present in the atmosphere, concentrations of CO_2, CH_4, and N_2O also are due to industrial processes, transportation technology, urban development, agricultural practices, and other human activity. The Intergovernmental Panel on Climate Change (IPCC) estimates that atmospheric concentrations of the GHGs: CO_2, CH_4, and N_2O have all increased since 1750 due to human activity. In

2011 the concentrations of these GHGs were 391 ppm11, 1803 ppb, and 324 ppb, and exceeded the pre-industrial levels by about 40 percent, 150 percent, and 20 percent, respectively (IPCC 2013).

Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon fuels have caused GHG concentrations (represented as CO_2 equivalents or CO_2 (e)) to increase dramatically and are likely to contribute to overall global climatic changes. The IPCC recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007b). The IPCC further concluded that these changes in atmospheric composition are almost entirely the result of human activity, not the result of changes in natural processes that produce or remove these gases (IPCC 2007b). Figure 3-3 shows U.S. GHG emissions by economic sector.

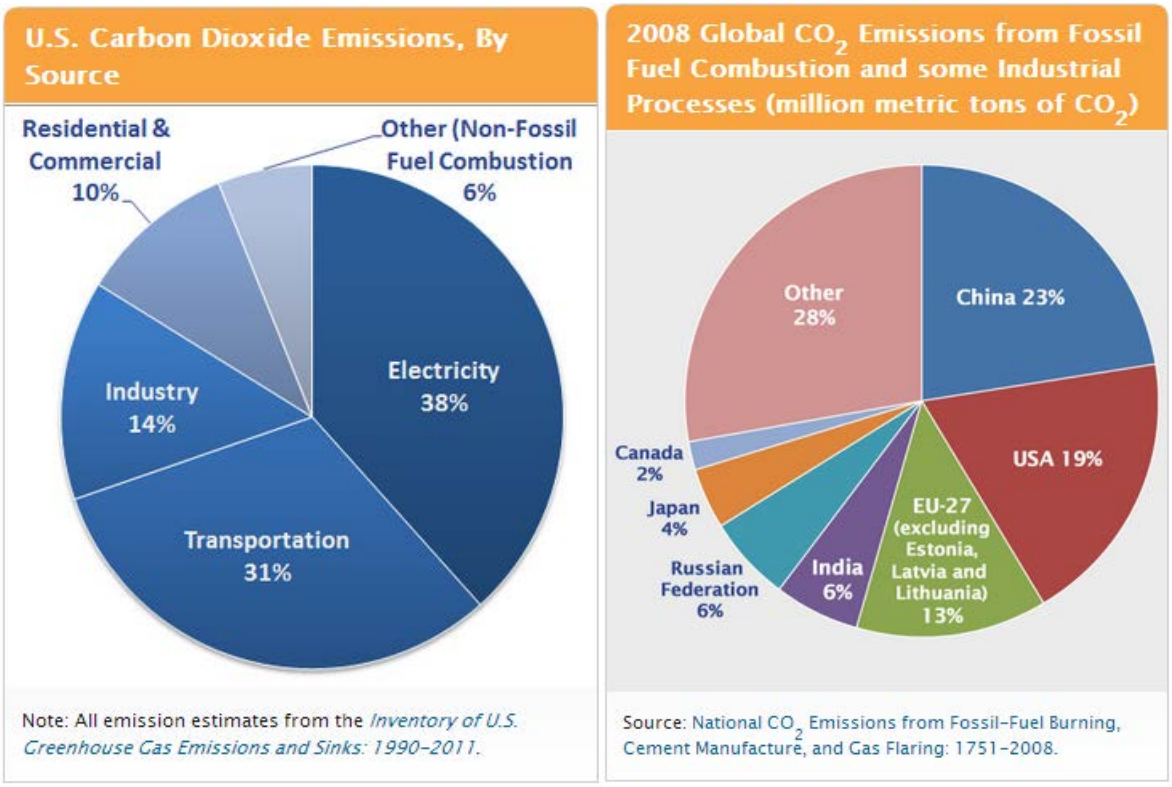
Figure 3-3. U.S. Greenhouse Gas Emissions by Economic Sector, 1990 to 2013



Source: U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013.
http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html

In Figure 3-4, the chart on the left shows how U.S. CO_2 emissions follow similarly to Utah's source characteristics. This is important when determining GHG effects in the aggregate. Looking at the chart on the right, we can see the U.S. percentage verses other countries. This chart is a good visual to see the amount the United States emits compared to other countries but economic diversity, social norms, and access to different energy and transportation sources must be factored in before making any across the board evaluations or decisions.

Figure 3-4. U.S. Carbon Dioxide Emissions and Global Carbon Dioxide Emissions



Global Effects

Meteorological and other environmental data show strong indications of climate change and are a relatively steep upward trend in observed global temperatures, especially in the last 50 years.

The globally averaged combined land and ocean surface temperature data as calculated by a linear trend, show a warming of 0.85 [0.65 to 1.06] °C, over the period 1880 to 2012, when multiple independently produced datasets exist. The total increase between the average of the 1850–1900 period and the 2003–2012 period is 0.78 [0.72 to 0.85] °C, based on the single longest dataset available (IPCC 2013).

Increases in temperatures would increase water vapor in the atmosphere and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict. Other unevenly distributed effects of climate change include altered sea levels, wildland fire occurrences, desert distribution, and plant and animal distribution. In 2007, the IPCC indicated that by 2100, global average surface temperatures could rise 2.0 to 11.5 °F (1.1 to 6.4 °C) above 1990 levels. Additional observed data are also consistent with a warming trend, including increases in global average sea level, observed decreases in snow and ice extent, changes in long-term precipitation in many regions, and changes in frequency and intensity of extreme weather events (IPCC 2007a).

Total U.S. GHG emissions have risen by 5.6 percent from 1990 to 2013 (http://www.epa.gov/climatechange/ghgemissions/inventoryexplorer/#allsectors/allgas/econsect/all).

The primary GHG emitted by human activities in the U.S. is CO_2, totaling approximately 84.8 percent of all GHG emissions, with the largest source being fossil fuel combustion. According to the EPA Inventory of U.S. GHG Emissions and Sinks (IPCC 2007a), CO_2 emitted in the U.S. totaled 7,054.2 teragrams in

2006. These GHG emissions are partly offset by carbon sequestration in forests, trees, urban areas, and agricultural soils, which, in aggregate, offset 12.5 percent of total U.S. emissions in 2006 (IPCC 2007a).

Increasing concentrations of GHGs are likely to accelerate the rate of climate change and potential global and regional effects in the future. There is evidence that climate changes are already affecting water resources, energy supply and use, transportation and infrastructure, agriculture, ecosystems, and public health, with effects varying from region to region (IPCC 2007a).

Regional Effects

The IPCC and Global Change Research Program include the Planning Area in the "southwest" region. Recent warming in the southwest region has been among the most rapid in the Nation, with the average temperature increasing approximately 1.5 °F compared to a 1960 through 1979 baseline period. Temperature increases are driving declines in spring snowpack in the region and flows in the Colorado River, combining with other factors to affect water supply (IPCC 2007a). Projections suggest continued strong warming, with much larger increases under higher emissions scenarios. By the end of the century (2100), average annual temperature is projected to rise approximately 4 °F to 10 °F above the historical baseline, averaged over the southwest region (IPCC 2007a). On regional scales, the confidence in model capability to simulate surface temperature is less than for the larger scales.

Current Condition

The BLM recognizes the importance of climate change and the potential effects it could have on natural and socioeconomic environments. Throughout the Planning Area, the BLM authorizes numerous types of activities and actions that result in GHG emissions, with contributors being the combustion of fossil fuels for on-road and off-road vehicles, engines, and construction equipment. Additional activities that result in GHG emissions include prescribed burns and other fire management activities; authorization of ROWs for energy development and transmission, roads, pipelines, and other uses; livestock grazing; and oil and gas and other mineral exploration and development. Although individually these activities result in small amounts of GHG emissions, they do contribute to the regional, national, and global pool of GHG emissions.

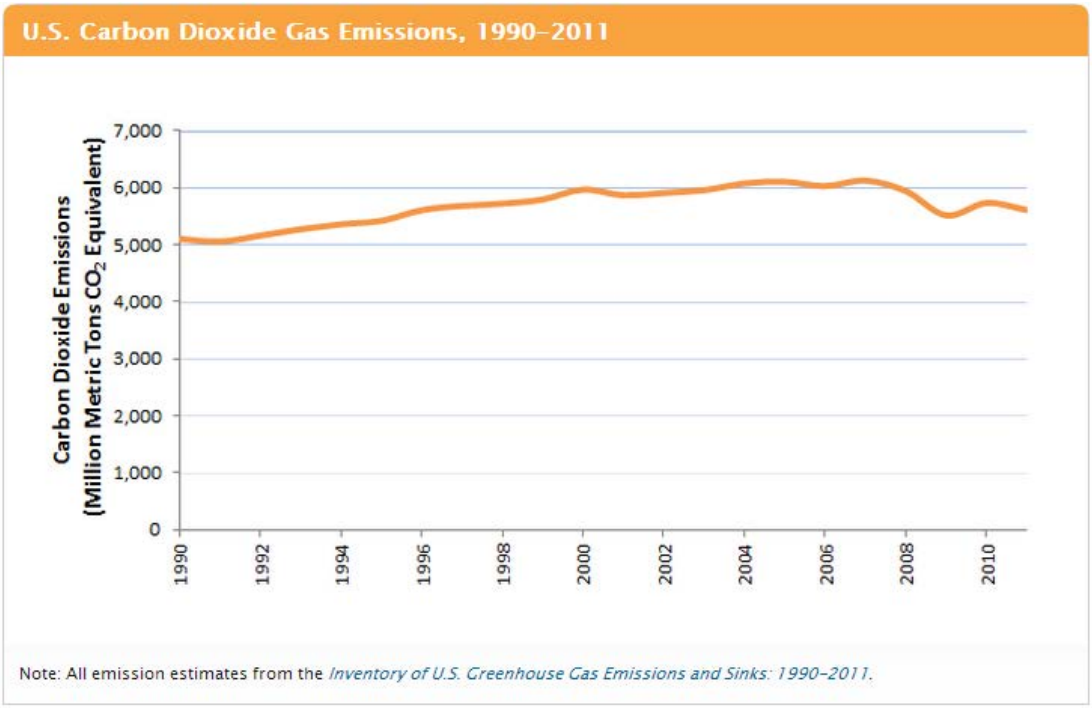
In addition to direct GHG emissions, indirect GHG emissions and other factors potentially contributing to climate change include fires; land use changes (e.g., converting rangelands to urban use); and wind erosion, fugitive dust from roads, and entrained atmospheric dust that darkens glacial surfaces and snow packs and results in faster snowmelt. Other activities could help sequester carbon, such as managing vegetation to favor perennial grasses and increase vegetation cover, which could help build organic carbon in soils and function as "carbon sinks."

Additionally, significant research and development efforts are underway in the field of carbon capture and sequestration technology. This technology is expected to become available in the next two decades and would allow the power generation industry to capture CO_2 and store it underground, drastically reducing emissions to the atmosphere (Department of Energy [DOE] 2007). There is also an increased emphasis on the development of renewable energy projects. Vehicle fuel economy standards will further serve to reduce CO_2 emissions worldwide. Ultimately, the levels of global dioxide emissions in the future will be determined by a mix of these technological, economic, and policy developments; thus, future increases and decreases in CO_2 emission rates remain uncertain at present.

Emissions have been decreasing over the last decade, as shown by Figure 3-5, for the U.S. Future goals of shrinking CO_2 (e) emissions are a high priority of the BLM and other government agencies. The science behind GHGs absorbing long wave radiation and having a warming effect is definitive. Even with the current state of climate change science, and its inability to link specific GHG emissions from any particular

action to climate change events, the cumulative effects of all projects are to be considered when comparing air resources to all development within this MLP.

Figure 3-5. U.S. Carbon Dioxide Gas Emissions, 1990-2011



Trends

Over the past 200 years, the burning of fossil fuels (e.g., coal and oil) and deforestation have caused the concentrations of heat-trapping GHGs to increase substantially in the atmosphere. These gases prevent heat from escaping to space, somewhat like the glass panels of a greenhouse. GHGs are necessary to life as we know it, because they keep Earth's surface warmer than it otherwise would be. However, as the concentrations of these gases continue to increase in the atmosphere, Earth's temperature is climbing above past levels.

According to National Oceanic and Atmospheric Administration and National Aeronautic and Space Administration data, Earth's average surface temperature has increased by approximately 1.2 to 1.4 ºF in the last 100 years. The eight warmest years on record (since 1850) have all occurred since 1998, with the warmest year being 2005. Most of the warming in recent decades is very likely the result of human activities. The past 15 years have had negligible increase in maximum temperature even though they have been some of the hottest in the continental U.S. Equilibrium climate sensitivity quantifies the response of the climate system to constant radiative forcing on multi-century time scales. It is defined as the change in global mean surface temperature at equilibrium that is caused by a doubling of the atmospheric CO_2 concentration. Equilibrium climate sensitivity is likely in the range 1.5 °C to 4.5 °C (high confidence), extremely unlikely less than 1 °C (high confidence), and very unlikely greater than 6 °C (medium confidence). The lower temperature limit of the assessed likely range is thus less than the 2 °C in the IPCC Fourth Assessment Report (2007a), but the upper limit is the same. This assessment reflects improved understanding, the extended temperature record in the atmosphere and ocean, and new estimates of radiative forcing. No best estimate for equilibrium climate sensitivity can now be given because of a lack of agreement on values across assessed lines of evidence and studies (IPCC 2013).

3.3 CULTURAL RESOURCES

3.3.1 Introduction

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. Cultural resources include archaeological resources, historic architectural and engineering resources, and traditional resources. Archaeological resources are areas where prehistoric or historic activity measurably altered the earth or where deposits of physical remains (e.g., arrowheads, pottery, bottles) are discovered. Prehistoric cultural resources are those materials deposited or left behind prior to the entry of non-Native American (i.e., European) explorers and settlers into an area. Historic cultural resources are those materials deposited or left behind after the European presence was permanently established. Architectural and engineering resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic value. Traditional resources can include archaeological resources, structures, topographic features, habitats, plants, wildlife, and minerals that Native Americans or other groups consider essential for the preservation of traditional culture. Cultural resources also include places identified by traditional groups (e.g., Native American tribes) as sacred or otherwise important to the maintenance of group identity, even if no physical manifestations of past activities are present at that location. These are identified as Traditional Values, and include locations referred to as Traditional Cultural Properties (TCP).

Some areas within the Planning Area have high densities of cultural resources and have been designated as ACECs with cultural values.

3.3.2 Resource Overview

The region that encompasses the Planning Area has a wide variety of environmental settings and resources that have long been used by humans. The Planning Area encompasses a large and diverse assemblage of prehistoric archaeological sites, historic archaeological sites and localities, and locations of traditional religious and cultural importance to various Indian tribes. For BLM management purposes, these remains take the form of sites, artifacts, buildings, structures, ruins, features, and natural landscapes with particular cultural importance. With a few exceptions, these remains must be at least 50 years old. In the case of natural landscapes, the period of traditional use of that landscape also must be at least 50 years old to be considered significant or eligible for/listed on the National Register of Historic Places (NRHP).

Occupation of southeastern Utah is divided into several distinct and temporally bounded time periods. The creation of distinct time periods has, in large part, been driven by differences in artifact assemblages through time. In many instances, this type of fine-scale division is informative. As new sites and artifacts are routinely being discovered, however, these divisions are susceptible to significant revision. The dates provided here serve only as general timeframe markers; any new dating technology advances or new discoveries will likely alter these date ranges. Nevertheless, five broad time periods will serve as temporal foundations for explaining human behavior in this area. An outline of these five periods and their associated behavioral trends is detailed below. These periods are defined temporally, behaviorally, and technologically. For additional information, a detailed overview of the prehistory and history of the region included in the Planning Area is presented in *Grand Resource Area Class I Cultural Resource Inventory* (Horn et al. 1994).

The basic periods include the Paleoindian, Archaic, Formative, and Late Prehistoric Stages, and the Historic period. Evidence of each of these periods is found within the Planning Area. The Historic period includes a period of Euro-American expansion into the region and contact with, and conflict between, Native Americans and Euro-Americans, followed by development of the area, including farming, ranching, and mining.

Prehistoric Culture History

Paleoindian Stage

The Paleoindian Stage (ca. 10,000 to 7,800 B.C.) is the earliest stage of culture history evident in the region and represents the adaptation to late Pleistocene environments. It is characterized by small groups of relatively mobile hunting and gathering peoples who used most sites only briefly. The Paleoindian toolkit typically included large, lanceolate (Clovis, Folsom, and Plano) projectile points (Schroedl 1991), spurred end scrapers, gravers and borers, and crescents (Frison 1978, Schroedl 1991). This stage is further split into three traditions including the Clovis (10,000 to 9,000 B.C.), Folsom (9,000 to 8,300 B.C.), and Plano (8,300 to 7,800 B.C.).

Archaic Stage

Late in the Pleistocene Epoch, the climate became warmer and drier which resulted in the expansion of desert vegetation zones and a concurrent retreat of cooler and moister vegetation zones to higher elevations. Changes in the climate caused a reduction in the distribution of Pleistocene wildlife, in some cases to the extinction of animals that were typically adapted to the cooler, moist climates. With changing climates came the expansion and modification of artifact assemblages as people adapted to a wider, more dispersed wildlife and plant resource base. The artifact assemblage associated with the Archaic Stage (7,800 B.C. to 500 B.C.) is typified as including large projectile points with side and corner notching and stemmed points, such as Humboldt Concave Base, Pinto series, McKean, Northern Side-notched, Sudden Side-notched, Mallory Side-notched, Gatecliff Contracting-stem, and possibly San Rafael Stemmed varieties (Holmer 1978), as well as basketry, cordage, netting, matting, fur clothing, tumplines as carrying devices, sandals, and atlatl darts.

Formative Stage

The Formative Stage (500 B.C. to ca. A.D. 1200) is characterized by the reliance on domesticated corn and squash, an increasing tendency for people to establish long-term village sites rather than continually moving about the landscape, substantial habitation structures, ceramics, and bow and arrow technology in the latter traditions. Two major traditions occur in the region: the Fremont tradition north of the Colorado River and the Ancestral Puebloan tradition to the south of the Colorado River. A third, the Gateway Tradition, has been used by a few archaeologists to identify archaeological sites that contain both Fremont and Ancestral Puebloan manifestations (Horn et al. 1994).

The Fremont adapted to the changing environment by using hunting and gathering subsistence styles of survival along with some horticultural farming. The variability of Fremont sites have caused archaeologists to classify Fremont manifestations as regional variants characterized by differing settlement and subsistence strategies. Those variants associated with the Planning Area include the Uinta Basin and San Rafael. Generally, the artifact assemblage associated with the Fremont includes gray, coiled pottery types distinguished by specific temper materials and decorative styles (Madsen 1977); one-rod-and-bundle basketry; leather moccasins constructed from the hock of a deer or mountain sheep; and ornate clay figurines with trapezoidal bodies (Horn et al. 1994).

The Ancestral Puebloan people, whose homeland centered in the Four Corners area of the American Southwest, have been identified as a sedentary, horticultural based group whose focus on corn, beans, and squash encompassed the later period. The Ancestral Puebloan tradition has been subdivided into periods (from earliest to most recent): Basketmaker II, Basketmaker III, Pueblo I, Pueblo II, and Pueblo III. The Basketmaker II period marked the transition from a hunting and gathering lifestyle to a more sedentary occupation of regional areas. In the Planning Area, sites associated with the Basketmaker II tradition have been documented as well as sites linked to the Puebloan traditions. Numerous storage cists, masonry structures, pit structures with storage features, and lookout structures have been recorded in addition to a

range of pottery types indicative of the Ancestral Puebloan time period; however, the documented artifacts do not provide a continuous spectrum of use. The lack of artifact assemblage continuity and lack of documented kilns may be more indicative of trading networks than of actual occupation by Ancestral Puebloan groups.

Late Prehistoric Stage

During the Late Prehistoric Stage, it is commonly believed that the Utes were the primary occupants of eastern Utah and western Colorado (Horn et al. 1994). Linguistic and archaeological evidence (especially ceramics) indicate that the Utes immigrated to the region by approximately A.D. 1100. Other evidence characteristic of Ute occupation includes sparse lithic scatters with low quantities of crude brownware ceramics, rock art, and occasional wickiups. In addition to the fingertip-impressed brownware ceramics, other diagnostic artifacts include locally designated Uncompahgre Brown Water and Desert Side-notched and Cottonwood triangular projectile points (Buckles 1971). As Utes interacted more with local Europeans during the late seventeenth and eighteenth centuries, varying quantities of Euro-American artifacts, such as sheet metal cone tinklers, tin cans, metal and glass projectile points, weaponry, and equestrian tack became part of the artifact assemblage.

The Navajo homeland is located south of the Planning Area, in the southeastern corner of Utah, northeastern Arizona, and in northwestern New Mexico (Brugge 1983). However, records indicate that the Navajo utilized portions of the Planning Area for a brief period of time.

The tribes that claim traditional affiliation with the Planning Area include Ute Mountain Ute, Southern Ute, Uintah and Ouray Ute, White Mesa Ute, Paiute, Navajo, Hopi, Pueblo of Zuni, Pueblo of Acoma, Pueblo of Laguna, Pueblo of Santa Clara, Pueblo of Zia, and Pueblo of Jemez.

Historic Culture History to ca. 1950

Historic cultural resources in the Grand and San Juan County area can be classified into one or more themes: Indian/White Interactions, Spanish Exploration, Fur Trade and Early Indian Themes, U.S. Government Exploration and Survey Expeditions, Initial Euro American Settlement, Ranching, Farming, Transportation/Railroads, Communication, Towns and Settlements, Mining, Mineral Exploration, Mineral Processing, Water Control, Speculative Ventures, Civilian Conservation Corps (CCC), Military, Federal Land Management, Antisocial Activities, and Ethnic Diversity (Horn et al. 1994). For a comprehensive discussion of the historic period in the region, see Horn et al. (1994).

Utes primarily occupied the region during the time of European contact. Contacts with Spaniards increased during the late 1700s and the early 1800s. At this time, the Spanish established the OSNHT (described in Section 2.11, Special Designations), which passes through the Planning Area. Use of the OSNHT started decades before this as Indian thoroughfares and the Spanish capitalized on this existing route. The OSNHT connected missions in southern California to the New Mexico trade centers of Taos and Santa Fe on the east. As cultural interactions with traders and travelers increased, changes occurred with Native American populations. The influx of Euro-Americans into the region eventually fostered conflicts with long-time Indian inhabitants that resulted in the creation of reservations and the movement of traditional peoples off their ancestral lands. Nonetheless, seasonal aboriginal uses of what are now Federal lands continued through the 1930s as groups continued to exploit resources in the canyons and adjacent mountains.

Exploration of the Grand and San Juan County area is first mentioned in the 1765 accounts of Juan Maria Antonio de Rivera who led an expedition through what is now Grand County. Traders and early travelers probably traversed through the Planning Area; very few left lasting records. Inscriptions remain the only lasting links between modern times and the fur trapper/trader era. U.S. government-sponsored exploration and survey expeditions in the middle to late nineteenth century and continued use of the OSNHT eventually

resulted in Euro American settlement of the Grand and San Juan County area beginning in the 1850s. As population increased, homesteads occupied locations where perennial springs promised consistent water for crops, livestock, and household uses. Camps, homestead remains, corrals, cellars, dugouts, privies, and transportation routes in the form of trails represent the early Euro-American occupation and use of the land encompassed by the Planning Area.

Euro-Americans, dependent upon ranching and farming, continued to expand and settle in various places in the Planning Area. Numerous towns sprang up throughout the Grand and San Juan County area. Physical remains dating from early town-building and isolated settlement activities dot the landscape and provide the Grand and San Juan County area with a rich historical archaeological record.

The railroad provided improved access to the Grand and San Juan County area, which fostered development. The area was further connected to the greater west with the completion of the Denver and Rio Grande Western Railroad in 1883, a narrow-gauge rail line that was replaced in 1890 by a standard-gauge line. The narrow-gauge rail located along the foot of the Book Cliffs was abandoned in favor of keeping the track along the Colorado River until eventually leaving its banks near Westwater and returning to the course along the Book Cliffs.

The rail line changed the area significantly as many rail line construction workers stayed in the camps that were built to facilitate construction of the rail line. These include communities such as Westwater, Cisco, Thompson Springs, Acheron, Cottonwood Station, Whitehouse Station, Sagers Station, Crescent Station, and Little Grand Station. The rail line replaced the arduous process of getting goods to and from the area by wagon.

The economic backbone of the Planning Area in the mid-nineteenth century focused on livestock ranching with cattle dominating the industry until the 1890s when sheep became a viable option. The remains of sheep camps, line camps, and stock driveways all indicate the pervasiveness of the livestock industry in Grand and San Juan County.

Remnants of CCC camps, dating from the 1930s to early 1940s, and numerous water control structures as well as farmer-constructed irrigation systems can be found throughout the Planning Area. In addition to ranching, mining has continued to have significant impacts to the region and its landscape, and as the twentieth century dawned, oil exploration created quite a stir. Likewise, the coal industry boomed briefly in the Book Cliffs region during the early 1900s, causing the construction of a narrow-gauge spur that connected the town and mill at Sego to the Denver and Rio Grande railroad at Thompson Springs.

The search for minerals has left a legacy of exploratory mines as well as two-tracks and roads. By the twenty-first century, mining generated routes added several thousand miles to the transportation network covering the Planning Area. In between the boom and bust cycles of the mining industry, ranching and farming sustained those who weathered the extractive industrial rollercoaster.

In 1929, Arches National Monument was created. This marked the beginning of the tourism and recreation activity in the Moab area.

National Register of Historic Places

Of the known sites on public lands within the Planning Area, two are listed on the NRHP as individual sites, landmarks, or part of a larger archaeological district. These include:

- Denis Julien Inscription, a site located in the vicinity of the Mouth of Hell Roaring Canyon
- Newspaper Rock Petroglyph Panel, a site located in San Juan County.

The Moab Rock Art National Historic District is being considered as a multiple-property listing, focusing on the large concentrations of rock art along Seven Mile Canyon, Kane Springs Canyon, Mill Creek Canyon, and the Colorado River. These areas provide a look into the cultural diversity and unique interactions among Native Americans, and Native Americans and Euro-Americans that likely took place in the Moab area over the past 2,500 years. To provide a visitor experience, viewsheds from rock art sites are a matter of concern within the Planning Area.

Areas of Critical Environmental Concern with Cultural Resource Values

The Shay Canyon ACEC contains cultural resource values, and is located within the Planning Area. This ACEC contains significant rock art associated with Archaic and Pueblo motifs.

The Behind the Rocks ACEC contains cultural resource values and is located within the Planning Area. This ACEC contains rock art and habitations sites associated with Archaic and Pueblo motifs.

The Highway 279/Long Canyon/Shafer Basin ACEC contains cultural resource values and is located within the Planning Area. Internationally known rock art is located within the ACEC.

The Ten Mile Wash ACEC contains cultural resource values and is located within the Planning Area. This ACEC contains significant cultural resources, including important habitation sites and unusual artifacts.

Potential Traditional Cultural Properties

TCPs include, but are not limited to:

- Locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world.
- Locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules of practice:
  - Ancestral habitation sites
  - Trails
  - Burial sites
  - Springs, perennial water sources
  - Places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken (Ferguson et al. 1993, Hopi Cultural Preservation Office 1995, Parker and King 1989).

No TCPs were identified during the scoping process for the Moab MLP/Draft Environmental Impact Statement (DEIS).

There are several site types, both archaeological and non-archaeological, that potentially could be identified by Native American groups as TCPs. The following is a general discussion about some of the archaeological and non-archaeological site types that may be identified as TCPs on lands managed by the BLM within the Planning Area.

Places of Traditional Native American Cultural Importance

Archaeological Sites

Many Native American groups claim affiliation with prehistoric archaeological sites such as rock art, burials, and village sites. The Hopi Tribe, for example, asserts that often the exact locations of some of these places, such as ancestral archaeological sites and burials, are unknown to tribes until these sites are

identified by Hopi cultural experts during ethnographic or ethnohistoric investigations, or by archaeologists during archaeological investigations of a given study area.

Not only do the Hopi consider these sites to be TCPs, they also believe that they are historic properties eligible to the National Register under Criteria A, B, C, and D for the following reasons (Ferguson 1997, Hopi Cultural Preservation Office 1995):

- Criterion A because they are associated with the Hopi clan migrations, which have made a significant contribution to the broad patterns of Hopi history.
- Criterion B because they are "associated directly with Ma'saw and the Hopi covenant to leave their footprints across the land."
- Criterion C because "ancestral archaeological sites, that may be individually anonymous, are identified as part of the great clan migration that are central to all that is Hopi."
- Criterion D because they have yielded or have the potential to yield information important to Hopi prehistory.

Other tribes also consider ancient Native American archaeological sites as places of traditional importance. For example, the Zuni have identified all "ancestral" archaeological sites as places of traditional importance, as well as being eligible for the National Register (Anyon 1995, Hart 1993). Zuni state that these sites meet Criteria A and B (as outlined in National Register Bulletin 15) because of their association with the Zuni ancestors and their oral migration histories. The Utes also consider some of these sites to be culturally significant and sacred and maintain that the spirit of their ancestors dwell at archaeological sites and will remain as long as the sites are not disturbed (Newton 1999, Perlman 1998). Recently, a spiritual leader of the Uintah and Ouray Ute Tribe stated that the disturbance of significant archaeological sites is leading to the destruction of Ute religion and diminishing the power of the spirits that remain at these sites (Molenaar 2003a).

Rock Art Sites

Many tribes have strong spiritual convictions regarding petroglyphs and pictographs and usually request that these sites not be disturbed, especially if the site was created with the intention of connecting with a spiritual or natural power. Many Ute and Puebloan groups also believe that rock art created by their ancestors retains the spirits of their ancestors.

Rock art panels are also seen by tribes as physical evidence for Native American land use indicating territorial boundaries, hunting and camping sites, and trail or migration markers. Some panels depict tribal stories and legends, but can only be interpreted by those with the specialized knowledge to understand their meaning. In the past, Utes have derived spiritual powers and authority from special petroglyph panels for their Bear Dances (Spangler 1995). The Uintah and Ouray Ute Tribes often request one-half mile buffers around rock art panels, if possible, during Section 106 consultations (Molenaar 2003b).

Rock Shelters

Rock shelters and cave sites located within the Planning Area can potentially be identified as TCPs. These locations include overhangs, crevices, and cave sites and are significant to Native Americans as ancestral dwellings. These site types are also potential ancestral grave sites for the Ute Tribe (Pettit 1990). These sites may also be identified as places where Native Americans communicated with the supernatural world by means of prayers, offerings, and vision quests (Molenaar 2003a).

Non-Archaeological Traditional Cultural Properties

Non-archaeological site types are distinguished from archaeological site types in order to discuss places that are not necessarily associated with prehistoric or historic artifact assemblages and collections. These

sites are typically identified by tribal representatives during the government-to-government consultation process that is required of Federal agencies. Some common site types are lakes and springs, land features, and traditional gathering or collection areas.

Lakes, Rivers, Perennial Streams, and Springs

Native Americans often claim places of water as places of traditional importance and have traditional stories about mythical beings, or water spirits that live in lakes, springs, and rivers. The Colorado River and its tributaries have sacred significance to the Navajo. According to the Navajo, when the Green River is impacted, the cultural integrity of the spring water is affected, which in turn affects traditional procurement use values (Molenaar 2003c). Perennial springs have been identified as sacred to the Navajo.

Traditional Gathering or Collecting Areas

Traditional plant or other resource gathering areas may be places of traditional importance to Native American groups. These areas are generally places where Native Americans go to collect resources such as medicinal plants and minerals to be used in curing health issues or in ceremonies.

Land Features

Large geographic regions, such as deserts, mountain ranges, and valleys are often identified as TCPs but few have been formally documented as such. Examples in the vicinity of the Planning Area include the LaSal Mountains, as well as any natural arch or prominent buttes.

Cultural Resource Distribution in the Planning Area

The number, nature, and location of cultural resources present within any given area of the Planning Area vary depending on numerous factors. Through extensive study of archaeological sites throughout the West, archaeologists have identified several key factors that influence site locations and types including elevation, slope, aspect, distance to permanent and/or intermittent water, and presence or absence of resources of interest (e.g., food or medicinal resources, valuable minerals, etc.).

The degree to which these factors influence the type and density of cultural resource sites in a given area also varies depending on the time period (prehistoric or historic) considered. For instance, technological advances during the historic period made it possible for people to live and work in areas that would have been less desirable during the prehistoric period. Long-term settlements or habitation sites, particularly during the prehistoric period, were typically located in areas with permanent water sources, so long as the area was at an appropriate elevation that didn't experience too harsh of a winter or that contained or was in close proximity to other areas that contained needed subsistence resources. Short-term camps, on the other hand, could be located in all types of environments and were typically focused on the exploitation of a specific resource during a specific time of year. Thus, in the high desert environment of the Planning Area, which experiences snow at higher elevations, short-term camps to gather plant or animal resources tend to be located on the higher plateaus and upper slopes of mountain ranges, and long-term settlements tend to be located at lower elevations, along permanent rivers and streams. As archaeological sites, short-term camps tend to have small numbers of artifacts, such as projectile points for hunting, that are typically associated with acquiring a specific resource and they generally lack permanent features such as living or storage structures. Long-term settlements frequently contain large numbers of artifacts and a wider diversity of artifact types, including items for processing rather than simply obtaining resources, and some evidence of structures. Many of these longer term sites in the Planning Area are associated with caves, alcoves, and rock shelters. Rock art sites, a common site type in the Planning Area, may be found in association with any environmental location where rock appropriate for pecking, grinding, or painting exists.

A limited percentage of lands within the Planning Area have been physically inspected for the presence of cultural resources, and such an effort is cost-prohibitive as part of preparing this plan. Therefore, the relative site density potential for areas within the Planning Area was estimated using environmental factors known to influence site location and type. Refer to the Proposed Resource Management Plan (RMP) and EIS for the Moab Field Office (2008a) (Sections 3.3.2.5 and 4.3.2.1) for the details regarding the methodology applied to the Planning Area. All areas of the Planning Area were then ranked as having either high, medium, or low potential for the occurrence of cultural sites (Table 3-12 and Map 3-2).

Table 3-12. Potential for the Occurrence of Cultural Sites

Site Probability	Estimated Acreage	Percent of Lands in the Planning Area
High	157,911	17%
Medium	468,765	50%
Low	319,789	33%

Source: BLM 2013a

More cultural resource sites are being visited, due to increasing public interest. This has resulted in an increase in interpretation, interest in preservation, public value, and political support. More cultural sites are also being identified during projects. The most widely visited cultural sites and cultural concentration areas in the Field Office according to BLM archaeologists are as follows:

- Upper Indian Creek
- Kane Creek Rock Art
- Lower Kane Creek Rock Art
- Muleshoe Canyon
- Levi Well Rock Art
- Highway 279
- Seven Mile Canyon
- Bartlett Rock Art
- Trout Water Rock Art
- Mill Canyon
- Jug Rock
- Dubinky Well
- Upper Hell Roaring Canyon.

Impacts to archaeological sites from increased visitors, recreational uses (especially off-road travel) and mineral-related exploration and development activities have increased in the last ten years.

3.4 LANDS AND REALTY

3.4.1 Resource Overview

As provided by the Federal Land Policy and Management Act (FLPMA), the BLM has the responsibility to plan for and manage public lands. As defined by FLPMA, public lands are those Federally owned lands, and any interest in lands (e.g., Federally owned mineral estate and easements across non-Federal lands), that are administered by the Secretary of the Interior, specifically through the BLM. The land surface and mineral ownerships within the MPA are varied and intermingled.

Moab Field Office Lands and Realty Program

Management of ownership and access to lands within the Planning Area falls under a variety of categories related to whether the BLM is retaining lands, acquiring lands or interests in lands, relinquishing control of lands (e.g., sales, exchanges, etc.), granting rights-of-way, easements, or other access, withdrawing lands for certain uses, or otherwise determining the disposition of specific tracts of land. The various categories of lands and realty management within the Planning Area are discussed in the following sections.

The overall goals of the BLM lands and realty program are to:

- Manage the public lands to support goals and objectives of other resource programs.
- Respond to public requests or applications for land use authorizations.
- Acquire administrative and public access where necessary to enhance the resource management objectives of the BLM.

Throughout much of Utah, the State owns and manages four isolated sections in each 36-section township. These are generally sections 2, 16, 32, and 36, and are ordinarily one square mile (640 acres). They are primarily administered by the Utah SITLA for the purpose of economic support of the State's public schools and institutional trust funds. Activities on State land generally are not substantially different from those on the surrounding land administered by the BLM. Many of the SITLA lands generate funds through grazing permits, right-of-way easements and permits, and hydrocarbon or other mineral leases.

Withdrawals

Withdrawals are formal actions that set aside, withhold, or reserve Federal land by statute or administrative order for public purposes. A withdrawal may remove areas from the public lands to be managed under the authority of another Federal agency or department, but the land does not leave Federal ownership.

Withdrawals are used to preserve sensitive environmental values, protect major Federal investments in facilities or other improvements, support national security, and/or provide for public health and safety. Withdrawals may segregate a particular portion of public land from operation of any, some, or all of the public land laws (withdraw from settlement, location, or entry), and/or prevent disposal (sale or exchange) of public lands or resources. Withdrawals remain in effect until they expire or are specifically revoked or terminated.

One withdrawal exists within the Planning Area (Map 3-3). This is called the Three Rivers Withdrawal, and it protects the Green, Dolores and Colorado River corridors in the Planning Area. The lands in the Three Rivers Withdrawal are withdrawn from mineral entry. In general terms, the withdrawals protect the corridors of the Colorado, Green, and Dolores Rivers from new mining claims subject to valid existing rights.

Utility Corridors

The 1985 RMP Management Action Decision for Utility Corridors established electrical utility corridors along I-70, U.S. 191, the Mid-America Pipeline Company pipeline route between I-70 and U.S. 191, and the Pacific Corporation transmission line route between U.S. 191 and the Green River (Map 3-4). The portion of the U.S. 191 utility corridor that runs through Moab Canyon has since reached maximum capacity (Map 3-5).

Needles and Anticline Overlook Roads

The BLM maintains the Needles and Anticline Overlook Roads within the Planning Area as Scenic Backways (Map 3-6). These roads were built by the BLM for scenic driving. The BLM has spent millions of dollars in the maintenance of these two scenic backways. Neither of these roads were built to a standard to accommodate heavy truck traffic.

Filming

The Moab Field Office is very active in the issuance of film permits, and is one of the busiest in the State of Utah. Many feature length films, as well as commercials and television productions, are filmed within the Planning Area. Filming locations within the Planning Area are identified on Map 3-7. The film industry on BLM lands contributes 98.5 jobs, $1.2 million in labor income, $4.3 million in total economic output, and $143,000 in State and local tax revenues.

3.5 LANDS WITH WILDERNESS CHARACTERISTICS

3.5.1 Resource Overview

Although BLM's authority to recommend lands for Congressional wilderness designation expired in 1991 under FLPMA § 603 (43 U.S.C. § 1782), Congress gave BLM broad authority and discretion under FLPMA, aside from § 603, to identify lands with wilderness characteristics and, if appropriate, to manage lands to protect such characteristics. The BLM also considers protective measures and impact minimization when formulating alternatives in the planning process.

All BLM lands within the Moab and Monticello Field Offices (which includes all lands within the Planning Area) underwent an initial inventory in 1979. The initial inventory led to some lands undergoing a more intensive inventory, which led to a subset of these lands being identified as Wilderness Study Areas (WSA). These lands have been managed since this identification to prevent impairment of their wilderness character until Congress decides on their final disposition. The Secretary of the Interior directed the BLM in 1996 to take another look at some of the lands originally inventoried in 1979. In response to the direction of the Secretary, the BLM inventoried these lands and approximately 2.6 million acres of public land statewide (outside of existing WSAs) were found to have wilderness characteristics (1999 Utah Wilderness Inventory). Approximately 951,120 acres were located within the Moab and Monticello Field Offices. As part of the 2008 Moab and Monticello RMP processes, the BLM reexamined its 1999 findings , and also determined that an additional 255,537 acres proposed by external groups possess wilderness characteristics. Since the RMP-related reviews, and as part of its responsibility to maintain a current inventory of lands possessing wilderness characteristics, the BLM has undertaken reviews of several areas identified both internally and externally as potentially possessing wilderness characteristics.

The process described above included lands within the Planning Area. The 1979 inventory found no lands within the Planning Area as possessing wilderness characteristics. The 1999 inventory reexamined 245,728 acres within the Planning Area (41.2 % of the Planning Area), of which 143,639 acres were determined to possess wilderness characteristics. The BLM again reviewed and updated its inventory for an additional 203,846 acres for the 2008 plans, representing an additional 28.4 per cent of the Planning Area. This review, conducted as part of the 2008 RMPs, identified an additional 48,581 acres as possessing wilderness characteristics. The total acreage identified as possessing wilderness characteristics within the Planning Area and analyzed in the 2008 RMPs thus totaled 192,220 acres (143,639 and 48,581). From the beginning of the MLP planning process through the end of the comment period on the MLP/DEIS, the BLM received citizens' inventories on nine units and has reviewed them. All nine of these units have been inventoried resulting in an additional 73,026 acres identified as possessing wilderness characteristics. A complete list of the lands identified by the BLM as possessing wilderness characteristics (265,246 acres) within the Planning Area is found in Table 2-4.

In early 2015, the BLM undertook a review and update of its inventory for the entire Planning Area. This process included:

- Identifying and reviewing current information on all roadless polygons exceeding 5,000 acres of BLM lands within the Planning Area.
- Reviewing all inventory information from the 1999 and 2007 inventories within the Planning Area.
- Reviewing all proposals and inventories submitted by external groups subsequent to the signing of the 2008 RMPs and prior to the end of the comment period for the MLP/DEIS.

The above review assured that BLM's inventory of lands possessing wilderness characteristics within the Planning Area is current and complete. Based on this review, there are a total of 265,246 acres identified by the BLM as possessing wilderness characteristics within the Planning Area.

Although the Glossary defines "wilderness characteristics" in detail for the purposes of inventory maintenance, for this plan, the BLM focused on the following criteria: 1) the appearance of naturalness; 2) outstanding opportunities for solitude or primitive or unconfined recreation; and 3) an area with a minimum of 5,000 acres in size (with some exceptions) so as to make practicable the management of wilderness characteristics. Lands with wilderness characteristics can be less than 5,000 acres if they are located adjacent to an area identified by the BLM or other agencies as possessing wilderness characteristics.

Non-WSA lands with wilderness characteristics are areas larger than 5,000 acres, or areas less than 5,000 acres that are contiguous to designated wilderness, WSAs, or other lands administratively endorsed for wilderness by other agencies or, in accordance with the Wilderness Act's language, are areas "of sufficient size as to make practicable its preservation and use in an unimpaired condition." The BLM used the same criteria for determining wilderness characteristics as in the 1979 wilderness inventory.

The BLM has the authority to conduct inventories for characteristics associated with the concept of wilderness and to consider management of these values in its land-use planning process. BLM's policy and guidance has recently been updated by Manuals 6310 and 6320 issued in March 2012. In addition, BLM's Land-use Planning Handbook (H-1601-1) states that decisions on whether or not to protect wilderness characteristics are to be considered during planning.

3.5.2 Current Management

There are 192,220 acres identified in the 2008 RMPs within the Planning Area that the BLM determined to have the wilderness characteristics of size, naturalness, and outstanding opportunities for solitude or primitive recreation (Map 3-8). Management identified in those RMPs does not manage these lands for their wilderness characteristics. Since the completion of the 2008 RMPs, BLM has identified an additional 73,026 acres as possessing wilderness characteristics.

3.6 LIVESTOCK GRAZING

Livestock grazing allotments occur on approximately 99.6 percent of all lands located within the Planning Area. A total of 37 allotments (or portions of an allotment) are authorized (Map 3-9). A total of 45,894 animal unit months are currently authorized (active) within the boundaries of the Planning Area. Table 3-13 displays the allotments within the Planning Area, the percentage of the allotment that is within the Planning Area, the BLM acreage of the allotment within the Planning Area, and the active Animal Unit Months (AUM) for the Planning Area portion of the allotment.

Table 3-13. Grazing Allotments within the Planning Area

Allotment Name	Percentage of Allotment within Planning Area	Allotment Acreage within Planning Area (BLM only)	Active AUMs for the Planning Area portion of the allotment (BLM only)
Arth's Pasture	100%	29,412	363
Athena	1.2%	454	14
Behind the Rocks	53.4%	20,991	880
Big Flat-Ten Mile	100%	117,268	4,701
Church Rock	67.6%	276	20
Dalton Wells	100%	2,508	21
Dry Valley-Deer Neck	49%	1,660	416
Fisher Valley	35.3%	4,559	299
Hart Point	100%	17,735	1,080
Harts Draw	100%	28,775	1,100
Hatch Point	84.8%	83,285	9,566
Highlands	63.3%	36,449	2,041
Horsethief Point	100%	11,706	4,701
Hurrah Pass	100%	17,414	262
Indian Creek	26%	59,044	2,215
Kane Springs	94.9%	14,224	291
Lisbon	5.8%	7,975	609
Little Grand	76%	65,581	3,178
Lockhart	94.6%	36,662	1,287
Lone Cedar	100%	18,452	1,960
Mail Station	100%	6,495	1,002
Monument Wash	72.9%	51,372	3,437
North River	8.4%	548	18
North Sand Flats (not available for grazing)	33.1%	6,618	0
Peters Canyon	9.4%	46	8

Allotment Name	Percentage of Allotment within Planning Area	Allotment Acreage within Planning Area (BLM only)	Active AUMs for the Planning Area portion of the allotment (BLM only)
Peters Canyon Wildlife Habitat (not available for grazing)	17.7%	1,328	0
Peters Point	99.8%	4,019	180
Potash	100%	11,400	316
Professor Valley	1.4%	262	5
Ruby Ranch	84.9%	22,814	565
Spring Canyon Bottom	100%	6,940	173
Spring Creek	24.4%	476	35
Squaw Park	94.8%	12,055	585
Tank Draw	100%	9,468	1,647
Taylor	42.4%	23,272	384
Tenmile Point	100%	43,331	1,830
Upper Mail Station	100%	1,802	74
Windwhistle	100%	5,429	631
Totals	**N/A**	**782,105**	**45,894**

3.7 MINERALS

The Planning Area is known to have significant occurrences of oil and gas and potash resources. The BLM prepared Mineral Potential Reports in 2005, as part of preparing the Moab and Monticello Resource Management Plans (2008), which provide an assessment of all mineral resources, including oil and gas and potash (BLM 2005b, 2005c, 2008a, 2008b). Also, as part of the Moab MLP process, the BLM completed Reasonably Foreseeable Development scenarios for oil and gas and potash in 2012 and 2014, respectively (BLM 2012b and BLM 2014a).

3.7.1 Minerals: Oil and Gas

Resource Overview

The Planning Area is within the Paradox Basin geologic province. As part of its 1995 National Assessment of United States Oil and Gas Resources, the U.S. Geological Survey (USGS) delineated oil and gas "plays" in the Paradox Basin (Gautier 1996). The Planning Area is wholly or partially within five of the oil and gas plays defined by the USGS. In March 2012, the USGS published the results of a more recent assessment of the petroleum systems of the Paradox Basin that was based on the total petroleum system rather than the plays concept (USGS 2012). However, to maintain consistency with the Moab and Monticello RMPs in describing oil and gas resources throughout the Moab and Monticello field offices, the 1995 data are used. Map 3-10 shows the areal extent of each oil and gas play within the Planning Area. Four of the five plays are of special interest relative to future exploration and development activity in the Planning Area. These four plays are:

- Play 2004 Cretaceous Dakota to Jurassic Play
- Play 2101 Buried Fault Block Play
- Play 2103 Fractured Interbed Play
- Play 2105 Salt Anticline Flank Play.

Play 2004 (Cretaceous Dakota to Jurassic Play) underlies a small area in the northern part of the Planning Area. This play includes oil and gas in conventional sandstone reservoirs in the Dakota Sandstone and Cedar Mountain Formation of Cretaceous age and the Morrison and Entrada Formations of Jurassic age. The Cretaceous and Morrison reservoirs are mostly fluvial in origin whereas the Entrada is eolian. Source rocks may be coal in the Dakota and/or organic-rich shales in the overlying Mowry and Mancos Shales. Oil and gas accumulations in this play include fields in the Greater Cisco and San Arroyo areas ten to 40 miles north and northwest of the Planning Area.

Play 2101 (Buried Fault Block Play) is present in the entire Planning Area except a small area in the southwest part. This play includes oil and gas trapped in porous dolomite or dolomitic limestone beds of the Upper Devonian McCracken Sandstone Member of the Elbert Formation and the Mississippian Leadville Limestone (Huffman 1996). The seals for these traps are the Pennsylvanian Paradox Formation evaporates that overlie the carbonate reservoirs or are in fault communication with them. Probable source rocks are the organic-rich black dolomitic shales of the Pennsylvanian Paradox Formation. Within the Planning Area, accumulations of oil and gas in this play include the Salt Wash, Big Flat, and Hatch Point fields. The largest accumulation of oil and gas in this play (Lisbon field) is located approximately six miles east of the Planning Area. The Lisbon field is one of the largest producing fields in Utah.

Play 2103 (Fractured Interbed play) underlies the entire Planning Area. This play is an unconventional continuous-type play that depends on extensive fracturing in the organic-rich dolomitic shale and mudstone in the interbeds between evaporites of the Paradox Formation or carbonate and clastic rocks of the related cycles on the shelf of the Paradox evaporite basin. Jointing and fracturing of the interbeds in the Paradox

Fold and Fault Belt are controlled by regional tectonics and more localized salt movement, dissolution and collapse (Chidsey, et al. 2004). This play is thought to be sourced from the same organic-rich black dolomitic shales and mudstones of the Paradox Formation (Huffman 1996). The Cane Creek Shale discoveries within the Planning Area are found in this play. Oil and gas fields in this play include the Big Flat, Long Canyon, Park Road, Hell Roaring, Kane Creek, Three Mile, LaSal, and Golden Eagle fields. In addition to the Cane Creek Shale, there are other organic shales in the play, notably the Chimney Rock, Gothic, and Hovenweep Shales, which may provide additional drilling targets for hydrocarbon accumulations (USGS 2012).

Play 2105 (Salt Anticline Flank play) is found underlying all but a small area in the southwest part of the Planning Area. This play is characterized by oil and gas productive Permian and Pennsylvanian reservoirs along the flanks of northwest-trending salt anticlines in the axial part of the Paradox Basin. Source rocks are thought to be organic-rich black dolomitic shales of the Hermosa Group, as well as coaly carbonaceous shale locally present at the Cutler-Hermosa contact (Huffman 1996). Extensive fracturing along the anticlines can also provide conduits from source rocks to reservoirs. There is no production from reservoirs in this play within the Planning Area. The largest accumulations in this play include the South Pine Ridge and Big Indian South fields in Utah and the Andy's Mesa and Hamilton Creek fields in the Paradox Fold and Fault Belt province of western Colorado.

The Planning Area is at the northern margin of Play 2102, the Porous Carbonate Buildup Play. This play is characterized by oil and gas accumulations in mounds of algal limestone and dolomitic reservoirs in five informal zones of the Pennsylvanian Hermosa Group within the Paradox Formation. Probable source rocks are the interbedded organic-rich black dolomitic shale and mudstone and laterally equivalent carbonate rocks within the Paradox Formation (Huffman 1996). Significant oil and gas accumulations occur in reservoirs in this play within the Blanding sub-basin approximately 20 to 50 miles to the southeast of the Planning Area. These include the Greater Aneth field, one of Utah's largest fields. However, only a very small acreage (roughly 700 acres) in the extreme southwest part of the Planning Area is within this play. Therefore, Play 2102 is considered inconsequential to future oil and gas development in the Planning Area.

Past and Present Exploration, Development, and Production

Oil and Gas Leasing Activity

Authorized and pending Federal oil and gas leases within the Planning Area cover a total of 228,428 acres. This is approximately 24 percent of the Planning Area. Federal oil and gas leases in the Planning Area are shown on Map 3-11.

Historical Drilling Activity

The Planning Area has had a long history of oil and gas exploration. Records from the Utah Division of Oil, Gas and Mining (UDOGM) indicate that approximately 227 wells were drilled in the Planning Area between 1912 and 2012 (UDOGM 2012). Of the 227 wells drilled, 198 wells have been plugged and abandoned (Map 3-12 and Table 3-14). There are no indications that past closures of oil and gas wells have resulted in impairments to groundwater. The BLM is aware of only one historic (1950s-60s) plugging failure that resulted in salt water reaching the surface from inside the production casing. There was no indication, direct or implied, of groundwater having been affected. The BLM required the operator to re-enter the well, drill out the salt and failed cement plugs, and re-plug the well. Of the remaining 29 active wells, 12 wells are currently producing oil, 15 wells are capable of producing oil or gas, one well is used for water injection/disposal and one well is actively being drilled. The wells listed in Table 3-14 are from the UDOGM data and are current as of June 1, 2012 (UDOGM 2012).

Between 1982 and 2012 66 wells were drilled within the Planning Area. The 30-year average is about two wells per year. Of the 66 wells drilled, 18 were oil well completions, three were gas well completions and

45 were dry holes. Based on these historical well drilling statistics, there has been a 32 percent drilling success rate in the Planning Area over the past 30 years. There have been several relatively short lived periods of slightly higher average drilling activity during the past 30 years. During a 3-year period between 1982 and 1984, the average drilling rate was just over three wells per year. A total of eight wells were drilled during 1991 and 1992. Drilling activity in the Planning Area has increased since 2007. The average number of wells drilled annually during the past six years has been 4.5 or a total of 27 wells.

Within the last 30 years 66 wells have been drilled in the Planning Area with an average of about two wells per year. However, the average number of wells drilled in the Planning Area since 2007 has been 4.5 wells per year and active drilling continues at present (UDOGM 2012). Drilling success in the Planning Area has increased over the past six years due to advances in horizontal drilling and geophysical technology. This upward trend in drilling success rates, combined with current and forecasted market conditions, favor a projected level of drilling activity above the recent 6-year average (2007-2012) rather than the 30-year historical average. The estimated total existing surface disturbance from oil and gas activity in the Planning Area is 318 acres. This estimate includes well pads and access roads.

Table 3-14. Status of Wells Located in the Planning Area

Well Status	Number of Wells
Producing Oil Wells	12
Shut-in Oil Wells	11
Shut-in Gas Wells	2
Temporarily Abandoned Wells	2
Plugged and Abandoned Wells	198
Approved Drilling Permits (not drilled)*	6
Pending Drilling Permits*	14
Active Drilling	1
Active Water Injection/Disposal Well	1
Total Wells	**227**

*Pending wells are not additive
Source: Modified from UDOGM, 2012

Historical Production

Fields in the Planning Area produce both oil and natural gas as natural gas is produced in association with oil. The Planning Area encompasses 15 oil and gas fields that produce mainly from reservoirs in the Buried Fault Block Play (Play 2101) and the Fractured Interbed Play (Play 2103). Total cumulative production from fields within the Planning Area is approximately 5.5 million barrels of oil and nearly 15.5 billion cubic feet of natural gas.

Present Development Activity

Infrastructure

The Dead Horse Lateral Pipeline located in the Big Flat area is the only gas production pipeline within the Planning Area. The natural gas produced in other parts of the Planning Area is used onsite (for benefit of lease), flared, or vented. Only 27 of the wells drilled in the Planning Area during the past 30 years are capable of production. Small changes in the total number of producing wells due to new drilling or well

maintenance activities can have a considerable impact on total annual production from wells in the Planning Area.

The Blue Hills Gas Processing Plant is the only gas processing facility located within the Planning Area. This plant is located in Sections 20 and 29, T23S-R19E.

Currently, there is one active water injection/disposal well within the Planning Area (UDOGM 2012). The injection well is in the Big Flat field, the State No. 16-1, and is authorized by UDOGM for disposal of produced water.

Hydraulic Fracturing

Hydraulic fracturing (HF) is a well stimulation technique used to increase oil and gas production from underground rock formations. HF involves the injection of fluids through a wellbore under pressures great enough to fracture the oil and gas producing formations. The fluid is generally comprised of a liquid such as oil, carbon-dioxide or nitrogen, and proppant (commonly sand or ceramic beads), and a minor percentage of chemicals to give the fluid desirable flow characteristics, corrosion inhibition, etc. The proppant holds open the newly created fractures after the injection pressure is released. Oil and gas flow through the fractures and up the production well to the surface.

HF has been used by oil and natural gas producers since the late 1940s and, for the first 50 years, was mostly used in vertical wells in conventional formations. HF is still used in these settings, but the process has evolved. Technological developments (including horizontal drilling) have led to the use of HF in unconventional hydrocarbon formations that could not otherwise be profitably produced.

The combined use of HF with horizontal drilling has led to an increase in oil and gas activities in areas of the country with historical oil and gas production, and an expansion of oil and gas activities to new regions of the country.

Within the Planning Area, horizontal drilling is typically conducted between 7,000 and 9,000 feet of vertical depth due to the primary target formation, which is the Paradox Formation, but is not limited to this depth range. Horizontal sections of a well may extend several thousand feet within the targeted formation from the production pad on the surface. Horizontal drilling involving advanced HF techniques have only been conducted within the Planning Area on a limited basis over the last few years. The amount of HF fluid utilized for HF in the Planning Area has amounted to less than 200,000 gallons per well. This is substantially different than North Dakota style HF operations for two reasons: 1) volume of fluid used in the Planning Area is far less than the 2 to 4 million gallons used in a typical Bakken Formation completion; and 2) the HF fluid used in the Planning Area is typically mineral oil or crude oil rather than water. In the Planning Area, the industry has found that the primary target formation conditions are not conducive to water-based HF methods and have proven detrimental to the recovery of oil and gas. HF utilizing oil (about 80,000 gallons per well) has recently proven more beneficial when applied to initially unsuccessful wells. The oil utilized in HF operations is recovered along with produced hydrocarbons and placed in production tanks and, therefore, the need for the storage of waste fluids is eliminated. In the future, the trend for using oil as HF fluid for initially unsuccessful wells is likely to continue. HF could be utilized for other target formations in the future, but the extent is unknown at this time.

Areas with the greatest oil and gas development interest within the Planning Area generally have Entrada and Glen Canyon Aquifers exposed at the surface and extending to a depth of approximately 1,000 feet. To ensure the effective isolation of these sensitive formations, a continuous string of steel pipe (or "casing") known as the "surface" casing is placed in the well, extending from the surface to at least 50 feet below the bottom of the aquifer. The entire length of that casing string is then cemented into place. The casing is then pressure tested to ensure there are no leaks before deeper drilling resumes. After drilling to the top of

the Paradox Formation at a depth of approximately 4,500 to 5,500 feet, a second continuous string of steel is placed inside the first, from the surface to the bottom of the hole. This casing string, known as "intermediate" casing, is then cemented into place with the goal of again cementing the entire length of casing. The intermediate casing string also serves to isolate water flows that may be present in the Cutler Formation. If the cement does not circulate all the way to surface, a cement bond log (CBL) or cement evaluation tool (CET) is run in the well to evaluate the effectiveness of cement placement. This casing string is then pressure tested and the well is drilled to the target formation and to the final well depth. As drilling continues to the target formation which contains oil and gas, the oil, gas and drilling fluids are contained within the casing. At this point in the procedure aquifers are separated from the fluids by two layers of steel casing and two layers of cement. When the final well depth has been reached, another steel casing string, known as "production" casing is then set inside the intermediate casing from the bottom of the well to the surface usually, but always to at least 200 feet above the bottom of the intermediate casing. This casing is then cemented from the bottom of the well to at least 200 feet above the bottom of the intermediate casing, and a CBL or CET is run to evaluate the cement on this casing string also. Within the Planning Area the Paradox Formation is generally 4,000 to 5,000 feet thick and is comprised mainly of salt, layered with thinner sedimentary zones, such as the Cane Creek Shale zone which is the principal producing target within the Planning Area and which occurs near the bottom of the Paradox Formation. The thick sequence of bedded salts is not only an effective confining zone, but is also a deterrent to aggressive HF design. Fracture propagation into the salt would provide a communication path between the salt and the well. Salt precipitates out of solution in the well, due to lower pressure and temperature, thus choking-off the flow of oil and gas from the well. For this reason, HF operations in the Planning Area bring with them an added risk of well damage.

Development Areas

The Planning Area has been divided into four geographic areas for the purpose of discussing development activities. Map 3-13 shows the locations of the four development areas located within the Planning Area. The following areas are each addressed separately when considering future oil and gas development:

- Eastern Paradox
- Salt Wash-Big Flat
- Hatch Point
- Hart Point.

The Eastern Paradox area comprises an enclave in the northeast part of the Planning Area with Arches National Park roughly located at its center. This area includes the Dome Plateau, Yellow Cat, and Klondike areas. The area also extends southeast to include Fisher Valley and the southwest rim of Castle Valley. The Eastern Paradox area is largely unproven since there are no producing oil or gas fields within this area. The Golden Eagle Exploration LLC, drilled three deep (16,000 feet +) wells on Dome Plateau between 2006 and 2010 that targeted the Cambrian age Lynch Dolomite. Two of the wells tested commercial quantities of gas. Another well was drilled by Delta Petroleum in 2006 on State land, just north and west of the Planning Area, which produces oil from the Paradox Formation (UDOGM 2012).

The Salt Wash-Big Flat area is located north of the Colorado River and Canyonlands National Park and, west of the Eastern Paradox area. The Green River is the western boundary of the area. This area includes the Big Flat, Bartlett Flat, Ten Mile and Salt Wash areas. There are nine oil or gas fields within this area, including six active fields, two inactive fields, and one abandoned field. Oil and gas production in this area is from reservoirs in the Buried Fault Block and Fractured Interbed Plays. As of July 2014, there are currently 20 producing wells, two wells are shut in, and seven wells have been drilled and are awaiting completion operations (UDOGM 2014).

The Hatch Point area is located in the central part of the Planning Area. The Colorado River forms the northern boundary of the area and the southern boundary is roughly the north rim of Hart Draw and the Needles Overlook road. This area includes the Hatch Point, Lockhart Basin, and the lower Indian Creek areas. Two formally defined oil and gas fields have been discovered in the Buried Fault Block and Fractured Interbed Plays. As of July 2014, there are four producing wells and one shut-in well.

The Hart Point area comprises the southernmost part of the Planning Area which includes the Indian Creek, Hart Point, and Dry Valley areas. The Hart Point area is unproven. Past drilling within the area has resulted in no wells which are capable of producing oil or gas in commercial quantities, although shows of oil and gas have been reported from several wells in the area.

Development Potential

Four oil and gas plays underlie the Planning Area which are important for future exploration and development activity. The plays are all associated with the commercial production of oil and gas and, therefore have a high development potential (BLM 2005b, BLM 2005c).

3.7.2 Minerals: Potash

Resource Overview

Potash resources within the Paradox Basin occur in the Paradox Formation which consists of a series of 29 evaporite (salt) cycles interbedded with shale, mudstone, and limestone. The salt cycles are numbered one through 29 beginning with the uppermost cycle. Potash (potassium-bearing) deposits, are comprised primarily of sylvite (potassium chloride) and carnallite (hydrated potassium magnesium chloride), and salt (sodium chloride). Potash is one of the last salts to precipitate during evaporite formation, and if present, is generally found near the top of each evaporite cycle. Potash is known to be present in 18 of the saline cycles, but only 11 of these layers contain potentially commercial deposits (Hite 1964, Dames and Moore 1978). The limit of salt deposition and the limit of major potash deposition in the Paradox Basin are shown on Map 3-14.

Past and Present Exploration, Development, and Production

Potash Leasing Activity

The rules regarding the management of potash resources on Federal lands are found in the Federal regulations at 43 CFR 3500 and the Mineral Leasing Act of 1920 as amended. The basic components of these rules involve competitive and noncompetitive leasing. Known Potash Leasing Areas (KPLA) are areas of known valuable potash deposits. Potash resources within a KPLA are leased competitively. Potash resources outside a KPLA are leased through a noncompetitive process involving prospecting permits and preference right leases. If a valuable potash deposit is identified as the result of exploration conducted under a prospecting permit, then the permittee is eligible for a preference right lease.

Two KPLAs were established within the Planning Area in the 1960s as a result of exploration activity for both oil and gas and potash. The Seven Mile KPLA was established on May 18, 1960 and includes about 5,156 acres. The Cane Creek KPLA was established on March 15, 1965 and includes about 34,696 acres.

The new Ten Mile KPLA (90,152 acres) was established within the Planning Area on May 5, 2012. No competitive leases have been issued within the KPLAs. However, the BLM recently received an expression of interest from two companies to competitively lease the entire Ten Mile KPLA. Preference right leases are located within the KPLAs that were issued prior to the establishment of the KPLAs.

Seven preference right leases have been issued within the Planning Area involving about 9,362 acres. The BLM has received 223 PPAs within the Planning Area which total about 416,464 acres. The KPLAs, potash preference right leases, and potash PPAs within the Planning Area are shown on Map 3-15.

Historical Drilling Activity

Potash deposits in the Paradox Basin were initially discovered during the exploration for oil and gas during the 1920s. The earliest documented discoveries of potash were from oil and gas wells drilled in 1922 south of Thompson and 1924 near Moab (Durgin 2011, Ringbolt Ventures Ltd. 2011). An oil and gas well drilled by the Crescent Eagle Oil Company in 1924, near Thompson, Utah encountered salt at a depth of 3,150 feet. The salt was analyzed and found to contain a mixture of sylvite and carnallite (USGS 1960, Dyer 1945). This discovery sparked interest in potash exploration and the Federal Government issued 68 prospecting permits. Most of the wells drilled under the prospecting permits did not encounter potash resources because they were shallow and did not intercept the potash zone (Dyer 1945).

The onset of using radioactive logs while drilling for oil and gas in the 1950s increased the ability to identify potash zones in the well bore (Hite 1977). Potassium, the key element in potash, has a radioactive isotope that appears as a peak on a gamma log. This makes it easier to identify the depth and thickness of the potash resources.

In 1949, Emmet Spencer filed PPAs on Federal lands in the Seven Mile area. These permits were issued in 1951. Based on the results of drilling on these permits, preference right leases were issued in 1955. Delhi Oil, Texas Gulf Sulfur, and Freemont Petroleum, and others were involved with the exploration conducted on the prospecting permits.

Additional historical accounts of potash exploration in the Planning Area are as follows:

- 1953: Delhi Oil Company (Delhi) drilled ten wells on one-half mile centers in the Seven Mile area (seven miles northwest of Moab) and identified a large source of potash.
- 1956: Delhi identified a large potash deposit at Cane Creek (Durgin 2011).
- 1956: Exploration identifies large potash deposits in the Cane Creek anticline (Morgan et al. 1991).
- 1960: Delhi-Taylor Oil Corporation sold property at Cane Creek that was withdrawn from oil and gas leasing to encourage the development of potash to Texas Gulf Sulfur (Graham v. Texas Gulf Sulfur Company, 457 F.2d 418 (1972)).
- 1961: The BLM issued prospecting permits, on lands located at T. 25 S., R. 20 and 21 E., to Guy Pitts and a preference right lease was issued in 1965. Additional prospecting permits were issued and a well was drilled in 1964 (Well #7-2, lot 3, sec. 7, T. 25 S., R. 21 E.).
- 1962: The Long Canyon Unit #1 well was drilled to a depth of 6,000 feet and a substantial amount of brine (saline water) was encountered. In another well near the Long Canyon Unit #1 well, the brine was artesian and drilling had to be suspended (Durgin 2011). This brine was analyzed at 468,000 total dissolved solids (TDS) (mg/l) with a pH of 3.0.
- 1973: Buttes Resources filed PPAs on Federal lands in the Ten Mile area, which were located west of Arches National Park.
- 1984: Buttes Resources was issued four Federal potassium preference right leases.
- 1985: Reunion Potash, who acquired Buttes Resources, filed for an additional 11 PPAs adjacent to their leases. These PPAs are currently pending subject to the outcome of an appeal regarding the designation of the Ten Mile KPLA.

Since the preference right leases were issued in the 1980s, potash prices remained depressed and there was little interest in the exploration and mining for potash until potash prices rose sharply in 2008. This spike in potash prices resulted in renewed interest in the potash resources of the Paradox Basin which is evident

by the submission of 223 PPAs to the BLM within the Planning Area. The following exploration activities have occurred in the Planning Area since 2008:

- 2011: Pinnacle Potash drilled a potash exploration well near Crescent Junction on State lands under the jurisdiction of the Utah SITLA (Stokes 2012).
- 2011: K2O drilled three wells at Hatch Point on State lands that are under the jurisdiction of SITLA. It was reported that major potash deposits were found in two of the three wells (Potash Minerals Limited 2012).
- 2012: K2O submitted an exploration plan to drill five wells on PPAs that it filed on Federal lands in 2008 near Hatch Point.
- 2012: American Potash submitted an exploration plan to drill four wells on PPAs that it filed on Federal lands in 2008 and 2012 near the Ten Mile Wash area.
- 2010 – 2012: American Potash submitted an exploration plan to drill four locations on State lands under the jurisdiction of SITLA, three locations have been bonded by the Utah Division of Oil Gas and Mining (Munson 2012).

No Federal potash leases have been issued within the Planning Area since 1985.

Present Development Activity

The Cane Creek Mine is located along the northern bank of the Colorado River and began as a conventional underground (room and pillar) mining operation for potash in 1963. The mining operation was plagued by difficulties such as a CH_4explosion in August 1963 (Rogers-Iversen 1963), floor heaves, sharp folding, brine pockets, and other issues. In 1970, the mine started changing over from conventional underground mining to underground in-place (in-situ) solution mining utilizing water from the Colorado River and solar evaporation ponds. Since 1972, the Cane Creek operation has been solution mining by pumping water from the Colorado River into the old workings of the Cane Creek Mine. The water dissolves the potash and the resulting brine is pumped to the surface. The salts, including sylvinite (a mixture of halite and sylvite), are precipitated in the solar ponds and then processed to produce sylvite. Halite (or "table-road salt") is also produced as a by-product. Currently, the operation produces about 100,000 tons of sylvite per year and has produced up to 260,000 tons of halite per year in the past.

Intrepid Potash, LLC acquired the Cane Creek Mine operation in the year 2000 and thereby obtained the only producing mine in the Paradox Basin. The mine is located within the Cane Creek KPLA which is comprised of State, private, and Federal lands. In 1985, the BLM issued a Federal potash lease within the KPLA which adjoins the Cane Creek Mine property. The lease was issued to the predecessors of Intrepid Potash.

In April 2002, well 27H was begun at the Cane Creek Mine and construction of a multilateral cavern system started when well 28H was drilled utilizing horizontal drilling techniques and technology. This cavern system was developed in salt cycle 9 by flushing the wells with fresh water, thus enlarging the wells to a sufficient diameter to begin commercial production. The greatest difficulty was keeping the drill bit in the ore horizon because the gamma meter, utilized for detecting potash, was 35 feet behind the drill bit (Harvey et al. 2006). This well is currently supplementing their production from the old workings in salt cycle 5. Solution mining in salt cycle 9 is expected to increase in the future and will provide additional production to the operation. In 2012, Intrepid Potash drilled a number of new wells into salt cycle 9 for the purpose of establishing production from the new wells.

Development Potential

Areas rated as high development potential includes the three KPLAs (Ten Mile, Seven Mile, and Cane Creek). The BLM classifies an area as a KPLA where there is a known valuable deposit of potash. Areas rated as moderate to high development potential includes the PPAs.

Potential Conflicts Between Oil/Gas and Potash

The BLM acknowledges that the development of the two commodities (oil/gas and potash) could occur at the same time. However, if commodity prices of both climb and successful production of both reaches a peak, it would be difficult to contain development while still meeting other resource objectives. Well pads, roads, and pipeline corridors could be shared to the extent possible. However, the two different development scenarios would have different infrastructure needs (power, pipeline, railroad with different destinations). The commodity developed first would be the first to develop infrastructure. Subsequent development could have different needs. Each infrastructure is developed with its specific needs in mind and don't directly overlay each other. Eventually this could lead to additional surface disturbance and impacts to meet the needs of both operators.

Co-location of two different operations could result in technical and legal conflicts. Depending on proximity they could be competing geologically. The actions of one could affect what's going on with the other. Potentially adverse conditions from co-locating could make it difficult to achieve resource objectives. Co-location of drilling operations on a single well pad would require a larger footprint and more surface impacts to accommodate all facilities and potential activities. If not co-located, there could be duplicative surface disturbance. Orderly development would be difficult to achieve with competing objectives on where and how to develop the minerals.

Conflicts between the potash and oil and gas industries in New Mexico began shortly after the discovery of potash in 1925 (ironically discovered by an oil test well drilled in the basin) and the first potash production in 1934. Secretarial Orders were issued in 1939, 1951, 1975, 1986, and 2012 in an attempt to resolve these conflicts. The Secretarial Order of 2012 has resulted in litigation by oil and gas operators who assert that the 2012 Order negatively affects valid existing oil and gas leases unlawfully cedes to the potash industry. BLM's statutory duties under the FLPMA and Mineral Leasing Act to manage the Secretarial Area and regulate valid existing oil and gas leases, and grants a disproportionate amount of power to the potash lessees who may veto certain oil and gas development within the Secretarial Area. Overall, the management of the two resources through the Secretary's Orders has been contentious throughout the years resulting in many disputes and court cases.

3.8 PALEONTOLOGICAL RESOURCES

3.8.1 Resource Overview

Paleontological resources are the fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, that are of paleontological interest and that provide information about the history of life on Earth (Paleontological Resources Preservation Act (PRPA), Section 6301; 16 U.S.C. 470aaa). Paleontology is a biological and geological scientific discipline involving the study of fossil materials. Paleontological resources, or fossils, include the body remains, traces, or imprints of plants or animals that have been preserved in the earth's crust since some past geologic time. Among paleontologists, fossils are generally considered to be scientifically significant if they are unique, unusual, rare, diagnostically or stratigraphically important, or add to the existing body of knowledge in a specific area of the science. The BLM considers all vertebrate fossils to be scientifically significant. Invertebrate and plant fossils may be determined to be significant on a case-by-case basis. Petrified wood is treated as a mineral material and may be collected under the Material Sales Act of 1947 (as amended), but cannot be obtained under the General Mining Law of 1872.

The types of fossils preserved in a sedimentary rock sequence depend on the geologic age of the rocks in which they occur and the environment in which the sediments that comprise the rocks accumulated. The types of rocks that crop out (are exposed) at the surface of an area and can potentially yield fossils is the result of geologic (depositional, structural, and erosional) history.

Geologic formations and sediments exposed at the surface of the Planning Area range from Precambrian to recent. Fossil-bearing sedimentary rocks range in age from Pennsylvanian to Quaternary in age and include parts of the three geologic eras of earth history during the Phanerozoic (*phaneros*, meaning visible and *zoic*, meaning life), the Paleozoic, Mesozoic, and Cenozoic. Fossils preserved in these deposits include invertebrate, vertebrate, and plant fossils. Vertebrate fossils include the body remains of fish, amphibians, reptiles (including dinosaurs), mammals, and birds, as well as their tracks and traces. These fossils can occur in rocks of Pennsylvanian, Permian, Triassic, Jurassic, Cretaceous, Paleocene, Neogene, and Quaternary age and include specimens unique to this area.

3.8.2 Current Management Practices

The BLM paleontology program is mandated by PRPA to manage paleontological resources using scientific principles and expertise. Natural or accelerated erosion, decay, improper collection, and vandalism can remove, alter, or damage those characteristics that make the paleontological resource scientifically important or enjoyable to the public.

A search of the Utah Geological Survey (UGS) fossil database in 2011 revealed a total of 357 paleontological localities in the Planning Area (UGS Fossil Locality Database 2011). Of the 357 paleontological localities identified, 135 are vertebrate localities; 62 are invertebrate localities; 53 are plant localities; and 145 are known to be trace fossil localities. Information from this database, supplemented by publications and personal experience, document that vertebrate fossils (which the BLM considers of scientific significance) are known from at least 14 formations that crop out in the Planning Area.

Additionally, a portion of the Dinosaur Diamond Prehistoric National Byway runs through the Planning Area. The Dinosaur Diamond Prehistoric Byway is a 512-mile driving route through Colorado and Utah that has educational kiosks and displays of dinosaur tracks and remains. Some sites have reconstructed skeletons and fleshed out recreations of dinosaurs. The portion in the Planning Area runs south from I-70 on U.S. 191 to Moab and returns to I-70 via U.S. 128. The BLM favors the development of museum

exhibits and informational kiosks or similar developments at roadside turnouts over the interpretation of areas where fossils remain in the ground. These projects provide opportunities for learning and enjoyment. There may be substantial risk of damage or unauthorized collecting of fossils by the public in interpretive areas that are not staffed.

The BLM has identified four objectives for the management of paleontological resources on lands it administers. They are: 1) locating, evaluating, managing, and protecting paleontological resources; 2) facilitating appropriate scientific, educational, and recreational uses of fossils; 3) ensuring that proposed land uses do not inadvertently damage or destroy important paleontological resources; and 4) fostering public awareness of the Nation's rich paleontological heritage (BLM 1998). Uniform procedural guidance for management of paleontological resources on BLM lands is provided by Paleontological Resources Handbook 8270-I.

Collection of paleontological resources from BLM lands in the Planning Area is allowed with some restrictions, depending on the significance of the paleontological resources. Under existing regulations, hobby collection of common invertebrate or plant paleontological resources by the public is allowed in reasonable quantities using hand tools. The public is also allowed to collect petrified wood without a permit for personal noncommercial purposes. People can collect up to 25 pounds plus one piece per person per day, with a maximum of 250 pounds in one calendar year. Currently, the Moab Field Office does not authorize any commercial collecting of petrified wood and prohibits the collection of petrified wood in the Gemini Bridges/Labyrinth Canyon SRMA. The Monticello Field Office has no restrictions on the location of private petrified wood collecting and commercial permits may be obtained for petrified wood. Commercial permits for the collection of other paleontological resources are prohibited by law.

Significant paleontological resources, which includes all vertebrate and any designated plant or invertebrate fossils, can only be collected by obtaining a permit that is issued to qualified researchers. Vertebrate fossils are the remains or traces of fish, turtles, dinosaurs, mammals, reptiles, and birds, and include material such as fossil bones, teeth, tracks, coprolites, and burrows. Significant plant and invertebrate fossils are determined on a case-by-case basis and must be identified in decision documents.

Three types of paleontological use permits are issued to qualified paleontologists in accordance with BLM Handbook 8270. The contract permit is associated with project work. The paleontologist has to be qualified by the BLM, and affiliated with a museum. The survey permit is a limited collection permit issued for reconnaissance work and collection of surface finds, with a one square meter limit on surface disturbance. If disturbance during the paleontological work will exceed one square meter, or will require mechanized equipment, the researcher must apply for an excavation permit. Prior to authorization of an excavation permit, the BLM must prepare an environmental assessment of the proposed location. All fossils collected under a permit remain public property, must be placed in an approved repository (e.g., a museum), and can never be sold. Annual reports of findings, including locality and specimen information, are required to be submitted to the BLM. Researchers may have multiple active permits.

Recreational fossil collecting of common invertebrates, plants, and petrified wood is appropriate on most lands administered by the BLM, except in developed recreation areas and other special management areas, such as SRMAs or where otherwise posted. Recreational collecting of vertebrate fossils, as well as noteworthy fossil invertebrates and plants is prohibited on all BLM-administered lands.

Professional paleontologists conducting research or assessment and mitigation are regulated through the permit process. Within the Planning Area, the BLM issued 50 of BLM Utah's 108 paleontology permits issued in 2015 which include 14 excavation permits, 21 survey permits, and 15 consulting permits.

Fossil theft and vandalism, particularly vertebrate fossils collection, occur with some regularity throughout the Planning Area. Only a small number of these occurrences are ever prosecuted. Escalating commercial values of fossils also mean that fossils on Federal lands are increasingly subject to theft and vandalism. These crimes reduce scientific and public access to scientifically significant and instructive paleontological resources and destroy the contextual information critical for interpretation. Illegal casting of dinosaur tracks, as well as theft of dinosaur bone, is particularly a problem within the Planning Area. Illegal casting of dinosaur tracks, which causes irreparable harm to the surface of the rock, and the theft of dinosaur bone, are ongoing concerns in the Planning Area.

The large number of new species, especially dinosaurs, that have been described in scientific literature over the past few years, is due to increased interest and awareness of the importance of paleontological resources in the Planning Area by paleontological researchers. This interest and awareness has led to the issuance of more survey and excavation permits, in addition to a greater number of consulting permits associated with pipeline and well pad construction.

3.8.3 Resource Characterization

Occurrences of paleontological resources are closely related to the geologic units that contain them. The potential for finding important paleontological resources can therefore be broadly predicted by the presence of the pertinent geologic units at or near the surface. Therefore, geologic mapping can be used as a proxy for assessing the potential for the occurrence of important paleontological resources. The Potential Fossil Yield Classification (PFYC) system was originally developed by the U.S. Forest Service's Paleontology Center of Excellence and the Region 2 (USFS) Paleo Initiative (1996). The guidance on the PFYC system is found in BLM Handbook 8270.

An additional subclassification system utilized by the BLM is the Paleontology Condition System, which classifies areas according to their potential to contain vertebrate fossils, or noteworthy occurrences of invertebrate or plant fossils, in accordance with BLM Handbook 8270-1, revised (BLM 1998a).

Under the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or uncommon invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is best applied at the geologic formation or member level. It is not intended to be an assessment of whether important fossils are known to occur occasionally in these units (i.e., a few important fossils or localities widely scattered throughout a formation does not necessarily indicate a higher class), nor is it intended to be applied to specific sites or areas. The classification system is intended to provide baseline guidance to assessing and mitigating impacts to paleontological resources. In many situations, the classification should be an intermediate step in the analysis, and should be used to assess additional mitigation needs. PFYC classes are defined in detail below:

Class 1: Geologic units that are unlikely to contain recognizable fossil remains. This includes units that are igneous or metamorphic in origin (but excludes tuffs), as well as units that are Precambrian in age or older. Management concern for paleontological resources in *Class 1* units is negligible or not applicable. No assessment or mitigation is needed except in very rare circumstances. The occurrence of significant fossils in *Class 1* units is non-existent or extremely rare.

Class 2: Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. This includes units in which vertebrate or significant nonvertebrate fossils are unknown or very rare, units that are younger than 10,000 years before present, units that are aeolian in origin, and units which exhibit significant diagenetic alteration (physical changes in rock which occur over time such as compaction, cementation, and mineral replacement). The potential for impacting vertebrate

fossils or uncommon invertebrate or plant fossils is low. Management concern for paleontological resources is low, and management actions are not likely to be needed. Localities containing important resources may exist, but would be rare and would not influence the classification.

Class 3: Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential. These units are often marine in origin with sporadic known occurrences of vertebrate fossils. Vertebrate fossils and uncommon nonvertebrate fossils are known to occur inconsistently, and predictability is known to be low. *Class* 3 includes units that are poorly studied and/or poorly documented, so that the potential yield cannot be assigned without ground reconnaissance. Management concern for paleontological resources in these units is moderate, or cannot be determined from existing data. Surface-disturbing activities may require field assessment to determine a further course of action.

The *Class 3* category includes a broad range of potential impacts. Geologic units of unknown potential, as well as units of moderate or infrequent fossil occurrence are included. Assessment and mitigation efforts also include a broad range of options. Surface-disturbing activities will require sufficient assessment to determine whether significant fossil resources occur in the area of a proposed action, and whether the action could affect the paleontological resources.

Class 4: These are *Class 5* geologic units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation. They include bedrock units with extensive soil or vegetative cover, bedrock exposures that are limited or not expected to be impacted, units with areas of exposed outcrop that are smaller than two contiguous acres, units in which outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic effects, and units where other characteristics are present that lower the vulnerability of both known and unidentified fossil localities.

The potential for impacting significant fossils is moderate to high, and is dependent on the proposed action. The bedrock unit is *Class 5*, but a protective layer of soil, thin alluvial material, or other mitigating circumstances may lessen or prevent potential impacts to the bedrock resulting from the activity. Mitigation efforts must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils are anticipated, on-the-ground surveys prior to authorizing the surface-disturbing action will usually be necessary. Onsite monitoring may also be necessary during construction activities. Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered. *Class 4* and *Class 5* units are often combined as *Class 5* for general application, such as planning efforts or preliminary assessments, as *Class 4* is determined from local mitigating conditions and the impacts of the planned action.

Class 5: Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils or uncommon invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation. These include units in which vertebrate fossils or uncommon invertebrate or plant fossils are known and documented to occur consistently, predictably, or abundantly. *Class 5* pertains to highly sensitive units that are well exposed with little or no soil or vegetative cover, units in which outcrop areas are extensive, and exposed bedrock areas that are larger than two contiguous acres.

Management concern for paleontological resources in *Class 5* units/areas is high, because the potential for impacting significant fossils is high. Vertebrate fossils or uncommon nonvertebrate fossils are known from the impacted area, or can reasonably be expected to occur in the impacted area. Assessment by a qualified paleontologist is required in advance of surface-disturbing activities or land tenure adjustments, and mitigation will often be necessary before and/or during surface-disturbing actions. Field surveys prior to authorizing any surface-disturbing activities will usually be necessary. Onsite monitoring may also be

necessary during construction activities. Designation of areas of special interest and concern may be appropriate. Class 3, 4, and 5 areas within the Planning Area are shown on Map 3-16.

3.9 RECREATION

3.9.1 Resource Overview

The Planning Area is an internationally recognized recreation destination. The proximity of Arches National Park and Canyonlands National Park, the extraordinarily scenic and diverse landscape, the accessibility of two major river systems (the Colorado and Green Rivers), the presence of interesting cultural and paleontological resources, and the opportunities for a wide range of recreational activities have made the Planning Area very popular for those seeking outdoor experiences. Visitors to the Planning Area engage in a wide array of both motorized and non-motorized recreational activities, many of which conflict with each other. Recreational activities within the Planning Area include but are not limited to camping, scenic driving, enjoying natural and cultural features, hiking, backpacking, canyoneering, mountain biking, horseback riding, hunting, rock climbing, building, antenna, span, and Earth (BASE) jumping, boating (rafting, canoeing, and kayaking), and off-highway vehicle (OHV) use.

Tracking visitor use is necessary for managing recreational use, including identifying trends, projecting and prioritizing future recreation management, identifying natural resource recreation settings, and calculating carrying capacities. Visitor use numbers are collected by means of traffic counters, visitor registrations, recreation use permits, and from other outside sources.

In general, the Planning Area experiences a high number of seasonal visitors and an intense demand for recreational activities. Busy seasons include both spring and fall, with spring bringing the most visitors to the area. The estimated annual visitation to BLM lands within the Planning Area is over 964,000 visitors. Visitation occurs throughout the year, with the spring season beginning in February and lasting through May, and the fall season running from September through November. Spring and fall visitors engage in the full range of recreational activities, including scenic driving, camping, hiking, jeeping, mountain biking, canoeing and rafting, rock climbing, OHV use, and horseback riding. Summer visitation is mainly associated with touring Arches and Canyonlands National Parks, and with river-related activities. The summer season also brings large numbers of visitors who engage in sightseeing activities, such as driving through the public lands and viewing the landscape from scenic overlooks, and some hiking and biking. In addition, organized group activities of many types also occur on public lands within the Planning Area.

The economy of the area is heavily dependent upon recreation-based businesses. Up to 342 guides and outfitters are currently operating on BLM lands within the Planning Area. These outfitters provide services for many activities including rafting, hiking, climbing, OHV use, photography tours, horseback riding, ballooning, hunting, canyoneering, and mountain biking.

In order to address the rapid growth in recreation opportunities and activities found within the Planning Area, and to ensure that sufficient and appropriate management is being applied in highly used areas, the BLM has developed specific Recreation Area Management Plans (RAMP). To date, three RAMPs have been developed for public lands within the Planning Area, including the Colorado Riverway, South Moab and Canyon Rims areas.

Special Recreation Management Areas

SRMAs are the BLM's primary means of managing recreational use of the public lands. Public lands are designated as a SRMA or Extensive Recreation Management Area (ERMA). SRMAs require a recreation investment where more intensive recreation management is needed and where recreation is a principal management objective. These areas often have high levels of recreation activity, contain valuable natural resources, or require recreational settings that need special management. ERMAs constitute public land that are managed to support and sustain the existing recreation use, demand, or program investments of an

area. Recreation may not be the primary management objective in ERMAs: therefore recreational activities are subject to fewer restrictions in ERMAs.

Two popular canyoneering routes (Repeat Jr. and Winter Camp Wash) are located within the ERMA. In addition, a portion of the Kokopelli's Trail, as well as the Top of the World Jeep Safari route are within the ERMA.

High use recreation trails and routes within SRMAs see the greatest concentration of visitors. Non-motorized trails provide opportunities for mountain bikers, equestrians, and hikers. While there are many miles of designated routes in the Planning Area, Jeep Safari routes are those most heavily used by motorized recreationists. These popular non-motorized trails and motorized routes are shown on Maps 3-17 and 3-18, respectively. They include those routes that are authorized for both commercial and organized group permittees. These routes are listed under each SRMA below.

Six areas within the Planning Area have been established as SRMAs (Map 3-19). The Canyon Rims SRMA, Labyrinth/Gemini SRMA, and Indian Creek SRMAs are located entirely within the Planning Area. The South Moab SRMA, Dolores River SRMA, and Colorado Riverway SRMA are partially located within the Planning Area.

To aid in the management of the diversity of recreational activities that occur in the Planning Area the BLM has identified Focus Areas or Recreation Management Zones (RMZ). Focus Areas are established to emphasize a specific recreation use and provide a specific set of recreational opportunities and facilities. Focus Areas set visitor expectations for a specific type of recreation experience, thereby reducing potential conflicts. Map 3-20 identifies Recreation Focus Areas found within the Planning Area.

Below is a description of the SRMAs and Focus Areas located within the Planning Area.

Canyon Rims Special Recreation Management Area (101,520 acres)

The Canyon Rims SRMA is located west of U.S. 191 and south of Moab. This SRMA is situated on a large plateau overlooking the Colorado River and is managed as a Destination SRMA. The SRMA has four developed overlooks of the Colorado River, two scenic byways, and two campgrounds, as well as the Trough Springs Hiking trailhead. The SRMA was established to protect, manage, and improve the natural resources of the area while allowing for recreation activities such as developed camping, visiting scenic overlooks, auto touring on the primary road system, touring the secondary road system by motorized vehicle and mountain bike, and hiking and backpacking the canyons.

Focus areas located within the Canyon Rims SRMA include:

- Hatch Wash Hiking and Backpacking Focus Area
- Needles and Anticline Roads Utah Scenic Backways.

High use recreation routes within this SRMA include:

- Non-motorized: Trough Springs (hiking), Hatch Wash (hiking)
- Motorized: Anticline and Needles Overlooks Scenic Byways.

Colorado Riverway Special Recreation Management Area (31,702 acres within the Planning Area)

The Colorado Riverway SRMA is partially located within the Planning Area and is managed as a Destination SRMA. The portion of the SRMA located within the Planning Area (31,702 acres) includes Shafer Basin, Kane Creek, Highway 279 and portions of U.S. 128, Porcupine Rim and areas south of Dolores River. Major activities include scenic driving, hiking, mountain biking, boating and camping.

Focus Areas located within the Colorado Riverway SRMA include:

- Scenic Driving Corridors:
  - These corridors include portions of U.S. 128 and the entire length of Highway 279 which are both designated as Utah Scenic Byways, as well as the Kane Creek/Hurrah Pass portion of the Lockhart Basin Scenic Backway.
- Specialized Sport Venue, Non-motorized:
  - Tombstone Competitive BASE jumping Focus Area
  - Wall Street Sport climbing Focus Area (44 acres).

High use recreation routes within that portion of the SRMA in the Planning Area include:

- Non-motorized Bike: Porcupine Rim Singletrack Bike Trail, Amasa Back/Pothole/Rockstacker/ Ahab Bike Trails, Hunter Canyon Rim, Jackson Trail, Kokopelli Trail
- Non-motorized Hiking: Hunter Canyon
- Motorized: Cliffhanger, Moab Rim, Chicken Corners, Pritchett Canyon, Porcupine Rim, Top of the World
- Climbing: Ice Cream Parlor, Tombstones of Kane Creek.

Dolores River Special Recreation Management Area (2,872 acres within the Planning Area)

The Dolores River Canyons SRMA is located about 25 miles east and south of Moab. This SRMA is managed as Undeveloped. The area has a limited number of roads, making motorized access difficult. Recreational use of this area is very light, with rafting and hiking being the most common activities. The only current infrastructure consists of directional signs.

Indian Creek Special Recreation Management Area (76,427 acres)

The Indian Creek SRMA is completely located within the Planning Area along State Route 211 and north of the town of Monticello, situated between the Needles District of Canyonlands National Park and the Abajo Mountains and Manti LaSal National Forest. Indian Creek SRMA is managed as a Destination SRMA and is considered the gateway to the Needles District of Canyonlands National Park. Indian Creek SRMA offers visitors the chance to experience a very unique remote landscape, which contains a world-renowned sandstone crack climbing area, a large number of cultural sites, a popular OHV access area, rare paleontological formations, and camping opportunities. This SRMA includes a wide range of recreational activities including sightseeing, camping, rock climbing, OHV use, cultural site visitation and photography.

Labyrinth/Gemini Special Recreation Management Area (275,788 acres)

The Labyrinth/Gemini SRMA encompasses a large portion of the Planning Area. It lies south of I-70, to the west of Arches National Park, with the southern portion of the SRMA bordered by Highway 279. The area was designated as a Destination SRMA for a wide range of recreational activities. Both motorized and non-motorized recreational activities can be found within the SRMA. Areas within the SRMA that have been identified to accommodate specific recreational uses include scenic driving corridors, open OHV use, mountain biking, BASE jumping, and hiking and equestrian areas.

Focus Areas located within the Labyrinth/Gemini SRMA include:

- Scenic Driving Corridors:
  - Highway 313 and the Island in the Sky Road (Utah Scenic Byway) are managed for scenic driving enjoyment.
- Non-Mechanized Recreation:
  - Goldbar/Corona Arch Hiking Focus Area (4,773 acres)

  - Spring Canyon Hiking Focus Area (455 acres)
  - Labyrinth Canyon Canoe Focus Area (6,812 acres)
  - Seven Mile Canyons Equestrian Focus Area (1,028 acres)
- Mountain Bike Backcountry Touring:
  - Klondike Bluffs Mountain Biking Focus Area (14,597 acres) located between Arches National Park and U.S. 191
  - Bar M Mountain Biking Focus Area (2,906 acres) located between Arches National Park, U.S. 191, and the Bar M area State lands
  - Tusher Slickrock Mountain Biking Focus Area (428 acres) located on Slickrock between Bartlett and Tusher Washes. The main access is from Bartlett Wash. The area is primarily managed for mountain bike and hiking use only. Cross-country mountain biking is allowed throughout the area.
  - Mill Canyon/Upper Courthouse Mountain Biking Focus Area (5,741 acres)
- Motorized Backcountry Touring:
  - Gemini Bridges/Poison Spider Mesa Focus Area (16,589 acres). This focus area is managed for multiple-use, including full-size OHV, ATV, and motorcycle use with consideration given to managing routes suitable for each vehicle type.
- Specialized Sport Venue (non-motorized):
  - Mineral Canyon/Horsethief Point Competitive BASE Jumping Focus Area (762 acres)
  - Bartlett Slickrock Freeride Focus Area, mountain bike only (166 acres)
- Specialized Sport Venue (motorized):
  - Dee Pass Motorized Trail Focus Area (21,158 acres). This focus area is managed for motorcycle and ATV use, and has been established for competitive motorized events.
- Managed OHV Area (cross country travel allowed):
  - White Wash Sand Dunes Open OHV Focus Area (1,944 acres).

High use recreation routes within this SRMA include:

- Non-motorized Bicycles: Portal Bike Trail, Bar M Bike Trail System, Magnificent Seven Bike Trail System, Klondike Bluffs Bike Trail System, Klonzo Bike Trail, Bartlett Slickrock Bike Trail, Lower Monitor and Merrimac Bike Trail, Moab Canyon Paved Bike Path
- Non-motorized Hiking: Corona Arch, Tibbetts Arch Trail, Goldbar Canyon systems, Spring Canyon
- Non-motorized Equestrian: Seven Mile Canyon, Moab Endurance Ride (Jug Rock) System
- Motorized Jeep Safari Routes: Crystal Geyser, Secret Spire, Hey Joe Canyon, Metal Masher, Copper Ride, 3-D, Wipeout Hill, Seven Mile Rim, Goldbar Rim, Golden Spike, Poison Spider Mesa, Hellroaring Rim
- Climbing/Canyoneering Areas: Long Canyon/Day Canyon/Culvert Canyon, Cameltoe Canyon, Granary Canyon, Needle Rock.

South Moab Special Recreation Management Area (23,143 acres within the Planning Area)

The South Moab SRMA is located south of Moab and to the west of the Manti-LaSal National Forest, with U.S. 191 being an approximate bisection. Only a portion of the SRMA (23,143 acres) is located within the Planning Area. Most of the area is easily accessible from Moab, and receives moderate to heavy recreation use and accommodates both motorized and non-motorized use. Infrastructure ranges from developed campgrounds to directional signing only. The SRMA is managed as a Destination SRMA.

Focus Areas located within the South Moab SRMA include:

- Non-Mechanized Recreation:
  - Behind the Rock Hiking Focus Area (4,076 acres)

- Specialized Sport Venue (Non-motorized):
  - 24 Hour of Moab Focus Area (2,914 acres)
- High use recreation routes within the portion of the SRMA in the Planning Area include:
  - Non-motorized Bike: Hunter Canyon Rim
  - Motorized: Kane Creek Canyon, Flat Iron Mesa, Behind the Rocks.

Off-Highway Vehicle

The management of OHV activities within the Planning Area includes monitoring and maintaining routes, installing fencing to protect natural and cultural resources on certain routes, coordination with local officials and other agencies, ongoing training on OHV related issues, and issuing citations and written warnings for OHV violations.

It is important to note that many OHV users in the Planning Area are residents of Colorado. In addition, OHV users come from the Wasatch Front of Utah, other western states, and from all over the country to ride OHVs on public lands within the Planning Area. The Planning Area has been featured in national OHV publications (four-wheelers, dirt bike, and four-wheel driving), and has become nationally known as an OHV destination. OHV demand is highest within the following areas:

- Near Dead Horse Point State Park including Gemini Bridges, Arth's Rim, Poison Spider Mesa, Gold Bar Rim, and Golden Spike
- Near Kane Creek, including Cliff Hanger, Kane Creek Canyon Road, Moab Rim, Hurrah Pass, Pritchett Canyon, Behind the Rocks
- Northwest of U.S. 191, including Wipeout Hill, Seven Mile Rim, Hey Joe Canyon, White Wash, Ten Mile, Secret Spire, 3D, and the White Wash area
- Lower Indian Creek including Hamburger Rock, Indian Creek Falls.

Special Recreation Permits

Five types of uses requiring Special Recreation Permits (SRP) are authorized, commercial, competitive, vending, individual, or group use in special areas, and organized group activity and event use. SRPs are issued to manage visitor use, protect natural and cultural resources, and accommodate commercial recreational uses, and may be issued for ten years or less, with annual renewal. Commercial SRPs are issued to outfitters, guides, vendors, recreation clubs, and commercial competitive event organizers providing recreational opportunities or service. SRPs for competitive and organized group events are also included in this category.

In 2012, 342 SRPs were issued by the Monticello and Moab Field Offices. While it is not known how many of these SRPs were exclusively for use within the Planning Area, it is assumed that due to the recreation opportunities found in this area that a large percentage of them did utilize the Planning Area. In total, approximately 122,486 clients were served by the SRPs generating gross revenue of roughly $15,774,040.

Developed Recreation Sites

Developed recreation sites incorporate visitor use infrastructure such as roads, parking areas, and facilities to protect the resource and support recreational users in their pursuit of activities, experiences, and benefits. Visitor use infrastructure is provided to focus and facilitate recreational activities. Within the Planning Area there are 58 developed recreation sites and overlooks (Table 3-15). The majority of these developed sites feature toilets, graveled roads, picnic tables, and fire grills. There is a fee to use most of the campground facilities; there is no fee charged for trailheads and overlooks.

Table 3-15. Developed Recreation Sites within the Planning Area

Type of Site	Visits (FY 2014)	Visitor Days (2014)	Field Office
Developed Campgrounds			
Big Bend	22,090	30,586	Moab
Cowboy Camp	2,385	4,551	Moab
Cowskin	(1)	(1)	Moab
Creek Pasture	(1)	(1)	Monticello
Dewey Bridge	3,190	3,713	Moab
Drinks Canyon	10,160	14,563	Moab
Goldbar	10,975	14,467	Moab
Hal Canyon	7,125	10,213	Moab
Hatch	670	1,622	Moab
Hamburger Rock	2,149	16,583	Monticello
Horsethief	10,583	20,196	Moab
Hunter Canyon	4,950	7,095	Moab
Indian Creek	5,394	30,516	Monticello
Jaycee Park	2,530	3,626	Moab
Kings Bottom	6,195	8,880	Moab
Ledge A, B, C and D	3,620	5,189	Moab
Lone Mesa	1,660	3,168	Moab
Moab Skyway	New-not yet open	New-not yet open	Moab
Moonflower	4,845	6,945	Moab
Oak Grove	4,215	6,042	Moab
Superbowl	(1)	(1)	Monticello
Upper Big Bend	4,370	6,264	Moab
Williams Bottom	8,265	11,847	Moab
Windwhistle	4,360	4,178	Moab
Developed Trailheads			
Amasa Back Trailhead	(1)	(1)	Moab
Bar M Trailhead	(1)	(1)	Moab
Blue Hills Road Trailhead	(1)	(1)	Moab
Copper Ridge Sauropod Trackway Trailhead	5,556	1,361	Moab
Corona Arch Trailhead	28,092	7,023	Moab
Courthouse Rock Trailhead	(1)	(1)	Moab
Donnelly Canyon Climbing Parking Lot	(1) Unknown	(1)	Monticello
Dubinky Road Trailhead	(1)	(1)	Moab
Entrada Bluffs Trailhead	(1)	(1)	Moab
Hunter Canyon Trailhead	(1)	(1)	Moab

Type of Site	Visits (FY 2014)	Visitor Days (2014)	Field Office
Kane Creek Canyon Trailhead	(1)	(1)	Moab
Klondike Bluffs Trailheads (2)	(1)	(1)	Moab
Kokopelli Trail Trailheads	(1)	(1)	Moab
Mill Canyon Dinosaur Trail Trailhead	10,124	3,147	Moab
Moab Rim Trailhead	(1)	(1)	Moab
Monitor and Merrimac Trailhead	(1)	(1)	Moab
Poison Spider Trailhead	(1)	(1)	Moab
Porcupine Rim Trailheads	30,900	10,043	Moab
Shay Canyon Loop Trail	(1)	(1)	Monticello
White Wash Sand Dunes Trailhead	(1)	(1)	Moab
Developed Sites and Overlooks			
Anticline Overlook	3,210	602	Moab
Canyonlands Overlook	(1)	(1)	Moab
Cliffline Interpretive Site	(1)	(1)	Moab
Mineral Bottom Boat Ramp	(1)	(1)	Moab
Minor Overlook	(1)	(1)	Moab
Monitor and Merrimac Interpretive Site	(1)	(1)	Moab
Needles Overlook	12,805	1,361	Moab
Newspaper Rock Petroglyph Site	96,379	9,638	Monticello
Sandy Beach Boat Ramp	(1)	(1)	Moab
Seven Mile Overlook	(1)	(1)	Moab
Take-out Beach Boat Ramp	(1)	(1)	Moab
The Knoll Overlook	(1)	(1)	Moab
The Meadow Overlook	(1)	(1)	Moab
Totals	**306,796**	**243,418**	-

(1) Visits and Visitor Days included in estimates of dispersed recreation for the SRMA in which the specific site is located. See discussion which follows. A visitor day is defined as 12 visitor hours in an area.

Dispersed Recreation

A wide range of dispersed recreation occurs throughout the Planning Area and takes place essentially in areas that are not identified as developed recreation sites. The majority of recreationists in these areas are participating in activities that emphasize solitude and undisturbed night skies and landscapes. Activities generally occurring in dispersed recreation areas include, but are not limited to, OHV use, mountain biking, rock climbing, automobile touring, hiking, horseback riding, and backpacking. Specific areas where dispersed recreation occurs within the Planning Area include Indian Creek Crossing, Lockhart Basin Road, rock art sites along Highway 211, Mill Canyon and Dubinky Well Road areas, Labyrinth Rims area, Labyrinth Canyon, and White Wash Sand Dunes. Popular bicycle and motorized vehicle routes include all Jeep Safari Routes, as well as single track bike trails in Bar M, Klondike and around Gemini Bridges.

The Planning Area receives a great deal of dispersed recreation use. In the past 15 years, the BLM has constructed and maintained a variety of recreation infrastructure. With visitation to BLM-administered public lands around Moab continuing to increase, additional facilities authorized in the 2008 RMPs will likely be developed. Even with continued recreation development, dispersed recreation is likely to increase throughout the Planning Area as more visitors are attracted to the region. Table 3-16 presents information on estimated dispersed recreation visits and visitor days in SRMAs located within the Planning Area. (For those SRMAs only partially located within the Planning Area, dispersed recreation visits and visitor days are allocated on proportionate acreage).

Table 3-16. Estimated Dispersed Recreation Visits and Visitor Days by Special Recreation Management Area within the Planning Area (FY 2014)

SRMA	Visits	Visitor Days	Field Office
Canyon Rims	48,566	9,918	Moab
Colorado Riverway	206,311	118,302	Moab
Dolores River	1,370	1,929	Moab
Indian Creek	7,106	10,828	Monticello
Labyrinth/Gemini	367,487	230,710	Moab
South Moab	26,661	15,419	Moab
Totals	**657,501**	**387,106**	

Note: A visitor day is defined as 12 visitor hours in an area.

User Conflict and Displacement

Recreational use and development has increased throughout the Planning Area, along with dispersed recreation use. Many recreationists have begun to move into areas with high mineral interest. Some recreation users see their use of the public land as the highest and best use. When recreational use reaches a certain threshold, it has been reported that user groups start to resent the multi-use nature of public lands.

State of Utah Scenic Byways and Backways

The Byway program was developed as a component of the National Scenic Byway Program. These Byways and Backways highlight the spectacular nature of the western landscapes and vary from narrow, graded roads, passable only a few months of the year, to two-lane, paved highways providing year-round access. Scenic Byways complement the National Scenic Byway Program by focusing on scenic corridors along major primary and secondary highways. A scenic byway has roadside corridors of special aesthetic, cultural, or historic value. Backways focus primarily on corridors along back country roads with high scenic, historic, archaeological, or other public interest values. The road may vary from a very rough road to a low speed, paved road that traverses back country areas.

Roads that are designated Backways rather than Byways are done for the primary reason of safety. These roads generally do not meet full Federal safety standards, meaning they are not wide enough, or graded enough to be safe year-round for passenger cars. They do, however, meet the highest standard of scenic, recreational, and historical criteria (Map 3-21).

State of Utah Byways

- **Highway 211 (Indian Creek Corridor Scenic Byway):** This 18-mile Byway is located 14 miles north of Monticello at the junction of State Route (SR)-211 with U.S. 191. From U.S. 191 the

Byway passes Newspaper Rock Recreation site and terminates at the Needles District of the Canyonlands National Park. This Byway is entirely located within the Planning Area.

- **Highway 279 (Potash-Lower Colorado River Scenic Byway):** Three miles north of Moab, U.S. 191 junctions with SR-270. The Byway follows the Colorado River through a meandering canyon for 17 miles to Jug Handle Arch. This Byway is entirely located within the Planning Area.

- **Highway 313 (Dead Horse Point Mesa Scenic Byway):** Located nine miles north of the town of Moab. This Byway includes incredible red rock canyon scenery, and pull-offs along the Byway provide interpretation of the geology, archaeology, and scenery of the highway. This Byway is entirely located within the Planning Area.

- **Highway 128 (Upper Colorado River Scenic Byway):** This byway travels northeast from the town of Moab through a red rock canyon following the Colorado River. The Byway is 44 miles long and in addition to unique scenery, it serves as a connecting route for motorists going to or from Moab and the nearby National Parks and BLM recreation sites. This Byway is partially located within the Planning Area.

Backways

- **Lockhart Basin Road (includes Hurrah Pass and on into Moab on the Kane Creek Road):** This backway follows Kane Creek Blvd from its intersection with U.S. 191 in Moab to the "Y" intersection with 5th West. The backway is located almost entirely on BLM lands. Views include the Colorado River, serpentine Kane Creek Canyon, Hurrah Pass and the canyon and cliff country adjacent to Canyonlands National Park. This backway is entirely located within the Planning Area.

- **Needles/Anticline Overlooks Road:** This backway is located off of U.S. 191, 12 miles south of the LaSal Junction. This backway travels across the Canyon Rims SRMA to access BLM's Needles and Anticline Overlooks. It is a total of 76 miles to access both overlooks and return to U.S. 191. The roads to each overlook offer views of Canyonlands National Park to the west and the LaSal Mountains to the east. From the Needles Overlook an expansive view of BLM's Indian Creek Wilderness Study Area and the Needles District of Canyonlands National Park can be seen. The Anticline Overlook is situated on a narrow promontory, and views include the Colorado River, Dead Horse Pont State Park, Hurrah Pass and Kane Creek Canyon. This backway is entirely located within the Planning Area.

3.10 RIPARIAN RESOURCES

3.10.1 Introduction

Riparian and wetland areas are sensitive vegetative or physical ecosystems that develop in association with surface or subsurface water (Leonard et al. 1992). Riparian and wetland ecological systems comprise less than two percent of the 785,567 acres of public lands within the Planning Area, but are among the most important, productive, and diverse ecosystems on the landscape. Benefits from riparian/wetland ecosystems are essential to both human and wildlife values and include:

- Maintaining clean, renewable water supplies
- Supporting various life stages for diverse flora and fauna, including special status species and fisheries
- Importance in cultural and historic values
- Economic value derived from sustainable uses (open space, hunting, livestock grazing; commercial recreation)
- Greenbelt associated recreation and scenic values
- Thermal/shade protection for both humans and wildlife, which is especially important within the arid Southwest
- Mitigate droughts and floods.

Riparian/wetland habitats are fragile resources and are often among the first landscape features to reflect impacts from management activities. These habitats are used as indicators of overall land health and watershed condition. Healthy riparian systems filter and purify water, reduce sediment loads and enhance soil stability, reduce destructive energies associated with flood events, provide physical and thermal micro-climates in contrast to surrounding uplands, and contribute to groundwater recharge and base flow (BLM 1991a).

3.10.2 Resource Overview

Riparian and wetland areas in the Planning Area include, but are not limited to, areas adjacent to waterways with either perennial or intermittent flows, areas with surface and/or subsurface water, springs, seeps, ponds or hanging gardens. Wetland areas include, but are not limited to, wet meadows, sloughs, marshes, swamps, and bogs; however, the Planning Area is almost devoid of these types of wetlands. Hanging gardens are an important riparian feature found in the Planning Area associated with seeps and springs on cliff faces or rock ledges. Riparian areas are recognized as "a form of wetland transition" between permanently saturated wetlands and upland areas (Leonard et al. 1992), and for BLM purposes, riparian and wetland and hanging garden areas are referred to synonymously as riparian resources unless specifically discerned (BLM 2008a, 2008b). Riparian and wetland ecosystems are classified by type based on hydrologic, geomorphologic, and biological factors (Cowardin et al. 1979).

The potential of these riparian systems is strongly dependent on the availability of water including the amount, timing, duration, and source of water availability, among other physical factors. Water availability is commonly described as perennial (year round), intermittent (continuously flowing more than 30 days) or ephemeral (flowing only after rainfall events or snowmelt conditions).

The BLM rates the condition of riparian/wetland areas using a process to assess Proper Functioning Condition (PFC). This rating is an indicator of riparian conditions which considers the hydrology, vegetation, and erosion/deposition attributes of each riparian/wetland area. The condition rating refers to how well the physical and biological processes are functioning in accordance with that site's capability and potential.

Riparian/wetland areas are rated as in PFC when adequate vegetation, landform, or woody debris is present to:

- Dissipate stream energy associated with high water flows
- Filter sediment, capture bedload, and aid floodplain development
- Improve floodwater retention and groundwater recharge
- Develop root masses that stabilize streambanks.

A functional-at-risk rating (FAR) is assigned when the riparian area only meets some of the elements in the PFC definition and has a high probability of degradation with a relatively high flow event. These areas must be assigned an upward or downward trend if previous documentation is available. A non-functioning rating (NF) is assigned when the riparian areas clearly lack the elements listed in the PFC definition. A rating of "unknown" may be assigned to riparian areas when there is no information available.

Utah Riparian Policy, updated in Sept 2005, provides specific guidance on management of BLM riparian lands in Utah. The purpose and objective of this policy is, to the extent possible, to maintain and/ or improve riparian areas to PFC. Changes in management or restoration actions may be needed in areas that have been determined to be in less than properly functioning condition in order to achieve PFC.

3.10.3 Riparian/Wetland Status

The BLM administers 15,468 acres of riparian resources on public lands within the Planning Area (Map 3-22). Specifically, 11,337 acres are located within the Moab Field Office portion of the Planning Area and 4,131 acres within the Monticello Field Office portion of the Planning Area, for a total of two percent of all BLM-administered lands in the Planning Area. The majority of these resources are located along the Colorado River, the Green River, and their associated tributary drainages including Kane Creek, Ten Mile Wash and Indian Creek.

Most riparian areas in the Planning Area have a diverse vegetation regime, with both native and non-native plants. Native plants include Fremont Cottonwoods, willows, sedges, rushes, and water-loving grasses. Non-native plants are often invasive and noxious and include Tamarisk, Russian olive, and Russian Knapweed. See Table 3-17 for a more complete list of plants that can be found within the Planning Area.

Table 3-17. Common Riparian Plant Species Occurring in the Planning Area

Common Name	Scientific Name
Native Riparian Species	
Fremont cottonwood	*Populus fremontii*
Narrowleaf cottonwood	*Populus angustifolia*
Gooding willow (black willow)	*Salix gooddingii*
Coyote willow	*Salix exigua*
Yellow willow	*Salix lutea*
Water birch	*Betula occidentalis*
Box elder	*Acer negundo*
Bulrushes	*Scirpus spp.*
Rushes	*Juncus spp.*
Spike-rushes	*Eleocharis spp.*

Common Name	Scientific Name
Cattail	*Typha spp.*
Invasive/Exotic Species	
Russian Olive	*Elaeagnus angustifolia*
Tamarisk	*Tamarix spp.*
Chinese elm	*Ulmus parvifolia*
Ravenna grass	*Erianthus ravennae*
Clematis	*Clematis spp.*
Phragmites	*Phragmites spp.*
Noxious Species	
Russian knapweed	*Acroptilon repens*
Purple loosestrife	*Lythrum salicaria*
Spotted knapweed	*Centaurea maculosa*
Bermudagrass	*Cynodon dactylon*
Bindweed	*Convolvulus spp.*
Broad-leaved peppergrass (tall whitetop)	*Lepidium latifolium*
Canada thistle	*Cirsium arvense*
Diffuse knapweed	*Centaurea diffusa*
Perennial sorghum (including Johnson grass)	*Sorghum spp.*
Musk thistle	*Carduus nutans*
Quackgrass	*Elytrigia repens*
Scotch thistle	*Onopordum acanthium*
Squarrose knapweed	*Centaurea squarrosa*
Whitetop	*Cardaria spp.*

Riparian/wetland ecosystems are important for wildlife year round but especially during the summer when temperatures often exceed 100º F and there is little shade or water. Demand for these diverse riparian/wetland ecosystems is high and may exceed the average capacity of these systems with resulting decreases in sustainability and condition.

Grazing uses of the riparian/wetland areas occur mainly in the fall, winter and spring months. Rest rotation grazing strategies are encouraged to provide some relief to riparian areas in spring during at least one year out of three. Certain riparian areas are fenced to exclude livestock.

Both the Moab and Monticello RMPs include decisions to avoid surface-disturbing activities within 100 meters (330 feet) of riparian areas, floodplains, streams, springs or other water features. These decisions apply to all oil and gas and potash exploration, drilling and development activities, including access roads and pipelines.

Invasive and/or Non-Native Species

While riparian function ratings can indicate the health of an ecosystem and be used as management tools, they do not in themselves reflect the degree of ecosystem diversity relative to invasive, exotic, or noxious plant species. Invasive and noxious species (namely tamarisk, Russian olive, and Russian knapweed) are now common within most riparian ecosystems in the Planning Area. Table 3-17 lists the common non-native riparian plant species found within the Planning Area.

Natural and human caused disturbances can lead to encroachment by invasive and/or non-native plant communities if these seed sources are present. Exotic and noxious species can alter individual riparian functions or processes, including:

- Invasive and noxious plant species often dewater riparian sites because they have deeper tap roots to out-compete natives for availability of water in arid environments
- Tamarisk secretes salt and increases soil and water salinity, resulting in reduced seed establishment of native species, and reduced downstream water quality
- Invasive and noxious plant species compete for sun and space in narrow habitats
- Invasive and noxious plant species proliferate more readily than native species, having larger numbers of seeds and longer seed establishment periods
- Invasive and noxious plant species communities typically reduce biodiversity (significant decreases in numbers and types of associated biotic species, including birds, bats, insects, amphibians, etc.)
- Invasive and noxious plant communities (e.g., *Typha spp.* and *Phragmites australis*), because of root and stem densities, can armor stream banks, promoting entrenched systems with highly destructive flooding energies which remain undissipated within deep channels. This results in high bank loss downstream, sedimentation, and salinization.

Current Riparian Conditions

Riparian and wetland conditions throughout the Planning Area were informally assessed prior to 2003 and each riparian/wetland area was assigned a condition rating. Since 2003 many of these areas have been evaluated by an ID team using the PFC assessment procedure and condition ratings have been adjusted. Certain areas have not yet been formally evaluated and assessed by an ID team, and their condition ratings are based on the original informal assessments. These informally assessed areas include the riparian areas within the Monticello Field Office portion of the Planning Area and several drainages within the Moab Field Office portion of the Planning Area. The evaluation and assessment work continues on these informally assessed areas on a project specific basis, usually completed for grazing permit renewals. Table 3-18 identifies acres of riparian areas by condition rating within the Planning Area.

Table 3-18. Riparian Condition Ratings within the Planning Area (BLM lands only)

	Moab Field Office (Acres within Planning Area)	Monticello Field Office (Acres within Planning Area)
Riparian	11,337	4,131
Proper Functioning Condition	5,427	Unknown*
Functioning at Risk	5,605	Unknown*
Non-Functioning	231	Unknown*

*No formal PFC assessments have been completed to date.

Tamarisk Leaf Beetle

In the fall of 2004 a biological control agent, *Diorhabda elongata* or tamarisk leaf beetle, was released by the Grand County Weed Department on private lands along a stretch of the Colorado River about six miles southwest of Moab. Over a period of several years, the leaf beetle population has become successfully established throughout the Planning Area. Repeated defoliation of Tamarisk trees is expected to continue through time, impacting the Tamarisk trees and creating standing dead or defoliated Tamarisk plants. This impact often results in the release of other invasive weed species such as knapweed, kochia and Russian thistle. Recovery of willow and other native riparian plant species is occurring, especially in tributaries and areas with less stream flow. Increased salinity levels in soils under older dense tamarisk stands and/or limited spring flooding and hydrologic controls affect the potential for cottonwood establishment. Therefore natural revegetation may not readily occur in certain areas and more active restoration techniques may be necessary to prevent erosion or degradation of these riparian resources.

3.11 SOCIAL AND ECONOMIC

The *Socioeconomic Baseline Report* (BLM 2012c) includes the current conditions, trends, and forecasts for the social and economic conditions. Socioeconomic conditions are summarized and updated below. Please refer to the *Socioeconomic Baseline Report* for detailed information.

3.11.1 Summary and Update of Socioeconomic Conditions

The *Socioeconomic Baseline Report* (BLM 2012c) provides information on social and economic conditions and the values associated with uses of BLM public lands for the socioeconomic study area (Grand and San Juan Counties, Utah). The report focuses on information that was most relevant to the scope of the BLM planning effort for development of the Moab MLP/EIS. This information was used for social and economic impact analysis of the management alternatives that were considered in the impacts analysis phase of the planning process. The information could be supplemented with additional data and information as needed for the analysis.

The information presented here summarizes and updates the conclusions of that report (written in May, 2013) to the present (April, 2014).

The socioeconomic study area has many significant economic and social conditions that affect the uses and values of BLM public lands and mineral estate in the Planning Area for the Moab MLP. The two Counties of the study area are considerably different both demographically and economically.

Some basic but important characteristics of the socioeconomic study area are as follows:

- A large majority of the land in the socioeconomic study area is Federally owned (72 percent overall). The BLM manages the largest amount of land (49 percent), followed by tribal ownership (20 percent), all other Federal agencies (16 percent), the State of Utah (9 percent) and private ownership (7 percent).

- The socioeconomic study area had a 2010 Census population of over 23,971, with 9,225 people living in Grand County and 14,746 living in San Juan County.

- The socioeconomic study area is very sparsely populated, with a few small population centers. The population density is 2.1 persons per square mile, compared to figures of 33.6 for the State of Utah and 87.4 for the nation.

- The socioeconomic study area is located at considerable distance from any large urban areas.

- The history of the socioeconomic study area is primarily a story of the native Indian cultures, settlement by Mormon pioneers, agricultural use, development of mineral resources, and recent influxes of residents and tourists attracted by the visual and recreational resources of the region.

Some important demographic and social conditions and trends in the socioeconomic study area include the following:

- The study area as a whole grew from 16,300 persons in 1970 to 23,971 persons in 2010, a gain of 7,671 persons, or 47 percent.

- From 1970 to 1980, both Counties grew significantly. This largely reflects an upsurge in mineral exploration and development during the 1970s. In the 1980s, San Juan County's population held

steady, but Grand County's population (and the population of Moab) dropped significantly. This is attributed to the collapse of the uranium mining industry in the 1980s. Both Counties (and Moab) grew in the 1990s. In the 2000s, Grand County had stronger growth than San Juan County—9 percent across the decade compared to 2 percent.

- The Governor's Office of Management and Budget projects modest amounts of growth to 2020 and from 2020 to 2030 in both Counties and in all the sub-County geographies for which the State makes projections. At present, no foreseeable changes are likely to increase the growth rates in the study area to rates similar to the fastest growing communities in the State.

- Housing growth in the socioeconomic study area in the 2000s was actually stronger than population growth. This reflects the attractiveness of the study area to second home owners.

- The components of population change in the 2000s varied considerably. Natural change (births over deaths) was much larger in San Juan County. Grand County had modest net migration from both domestic and international immigrants to the County. San Juan County had substantial *negative* net migration, led by domestic *out-migration*.

- The Grand County population is predominantly White—89 percent. The proportion of all minorities (i.e., all persons except non-Hispanic Whites) in Grand County is 15.9 percent. This is a smaller percentage of minorities than for the State as a whole, and much smaller than for the nation. In San Juan County, the percentage of Whites is much lower—45.8 percent. Minorities, particularly Native Americans, make up 56.1 percent of the County's population.

- The age profile in Grand County is generally older than in San Juan County. The median age in Grand County, 40.5 years, is considerably greater than in San Juan County, 30.0 years.

- A very high proportion (compared to Utah and the nation) of the population of San Juan County speaks a language other than English at home.

- The median family income in Grand County is over $10,000 lower than that of Utah, and the median family income in San Juan County is nearly $20,000 lower than that of Utah. Per capita income in Grand County, however, is slightly higher than that of the State, but in San Juan County is considerably lower than the State average[1]. Factors contributing to these differences include the rural nature of the study area, lower education levels, the younger population profile of San Juan County, high minority and reservation populations in San Juan County, and other factors.

- Grand County has a significantly higher percentage of multi-unit housing structures than San Juan County, but a significantly lower percentage than the State. Both Counties have significantly higher percentages of mobile homes than the State.

- The average household sizes for both owner- and renter-occupied units in Grand County were considerably lower than the corresponding figures for San Juan County and the State. Low household sizes are typical of areas where the population of adults is skewed toward younger (pre-child-raising) and older (post-child-raising) cohorts.

- County and local governments in the socioeconomic study area provide a wide range of public services.

[1] *Utah Department of Workforce Services 2011a*

- Many types of stakeholders to BLM public lands exist. At a high level, key types of stakeholders include Habitat and Resource Conservation Stakeholders, Recreation Stakeholders, Mineral Development and Production Stakeholders, and Visual Resource Stakeholders. These categories are not mutually exclusive; many specific individuals or organizations have multiple interests and have views that place them in more than one stakeholder category.

- None of the identified places in Grand County meet the thresholds to qualify as a potential Environmental Justice population. A number of places in San Juan County have minority populations and/or populations in poverty that may qualify as Environmental Justice populations. These places are primarily smaller communities. All but Blanding are located at considerable distance from the Planning Area. These communities have been identified for further consideration in the impacts analysis phase of the planning process.

Some important economic conditions and trends in the socioeconomic study area include the following:

- Unemployment rate changes in the two Counties generally mirrored State and national trends from December 2008 to December 2011. In Grand County, the unemployment rate has been about two to four percentage points higher than the statewide rate, which peaked at just over eight percent in early 2009. The Grand County rate peaked later, at about 11.5 percent in mid-2011. Rates in San Juan County were at essentially the same level (approximately eight percent) in December 2008 as in Grand County, but rose to over 13 percent in late 2009 and stayed at or near that level until mid-2011, when the unemployment rates began to come down. As of February, 2014, unemployment in Grand County stood at an estimated 6.9 per cent and San Juan County at an estimated 9.0 per cent. The estimate for the State as a whole was 3.9 per cent (Utah Department of Workforce Services 2011b). For Grand County, employment data tends to be highly seasonal, with employment rates increasing during the tourist season (typically March through October).

- Based on employment, the largest industries based in Grand County as of June, 2013, were *Accommodation and Food Services* (1,795 jobs, or 32.5 percent of all non-farm employment), *Government* (19.3 percent), and *Retail Trade* (14.6 percent). The largest industries in San Juan County in 2009 were *Government* (1,599 jobs, or 38.2 percent of all non-farm employment), *Education, Health and Social Services* (15.1 percent), and *Accommodation and Food Services* (13.1 percent). *Mining* (all types, including minerals) comprised 2.0 percent of jobs in Grand County and 8.8 percent of jobs in San Juan County[2].

- From 2000 to 2012, the industries experiencing the greatest numerical growth in jobs in Grand County were *Leisure and Hospitality* (218 jobs added), *Local Government* (143 jobs added), and *Education and Health Services* (111 jobs added). The San Juan County industries experiencing the greatest numerical growth in jobs in this period were *Education and Health Services* (238 jobs added), *Natural Resources and Mining* (162 jobs added), and *Professional and Business Services* (138 jobs added).

- Based on earnings, the three largest industries in Grand County in 2012 were the same as the three largest industries by number of jobs. These are *Leisure and Hospitality*, *Trade, Transportation, and Utilities*, and *Local Government.* In San Juan County in 2012, the three largest industries by employment were *Local Government*, *Education and Health Services, and Leisure and Hospitality.* In terms of total wages, the three largest industries were *Local Government, Natural Resources and Mining, and Education and Health Services.*

[2] *Utah Department of Workforce Services 2011c*

- In terms of earnings growth, in Grand County, *Leisure and Hospitality* had the largest numerical gain in earnings from 2000 to 2012 followed by *Trade, Transportation, and Utilities* and *Local Government*. In San Juan County, the largest numerical increases in earnings from 2000 to 2012 were in *Natural Resources and Mining*, *Education and Health Services*, and *Local Government*.

- The average annual wage in Grand County in 2012 was $ 28,772. In San Juan County, the average annual wage in 2012 was $ 32,651. These figures compare to an average annual wage in Utah of $ 41,301. It is typical for wages in rural Counties to be lower than the State average, which includes large populations in high-wage urban areas.

- The highest average wages in Grand County in 2012 were in the *Natural Resources and Mining* sector at $67,740, followed by *Federal Government* ($52,580), and *State Government* ($45,530). The highest average wages in San Juan County in 2012 were in the same industries: *Natural Resources and Mining* ($54,678), *Federal Government* ($49,017), and *State Government* ($33,953)[3].

- From 1970 to 2012, the percentage of total personal income in Grand County from labor earnings declined from 85 percent to 53 per cent and in San Juan County from 70 percent to 56 percent. These trends generally correspond to national trends, reflecting the aging U.S. population, who rely more on non-labor income than do employed persons.

- In Grand County in 2012 the dividends, interest, and rent component of non-labor income was much larger than the transfer payments component. In San Juan County, the pattern was reversed, with transfer payments being 140 per cent as large as dividends, interest, and rent. This is probably due to two main factors. One is the older population profile, including retirees, of Grand County—older persons tend to have more assets that provide dividends, interest, and rent. The second is the large Native American population of San Juan County, both on and off the reservation. This population tends to receive more government assistance than non-minority populations.

- Analysis of local government revenue data for FY2013[4] shows that in Grand County tourism-related tax revenues[5] totaled $5,976,088, while natural resources-related tax revenues[6] totaled $3,067,331. In San Juan County this pattern was reversed; tourism-related tax revenues totaled $654,241, while natural resources-related tax revenues totaled $8,725,678.

- Management of BLM-administered land may affect State and local expenditures for maintenance of roads, law enforcement and emergency response services, and other services.

The biological and physical characteristics of BLM-managed surface lands and BLM-managed Federal mineral estate lands in the Planning Area, coupled with social and economic conditions and trends within the socioeconomic study area (e.g., mining industry trends, local recreation demand, broader tourism patterns), together strongly affect the many uses and values of BLM public resources. Particularly notable aspects of those uses and values include:

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[3] *Source for the above five paragraphs: U.S. Bureau of Labor 2014.*

[4] *Source for data in this paragraph: Utah State Tax Commission 2014.*

[5] *Tourism-related revenues exclude property taxes levied on tourism-related properties and most sales taxes levied on purchases by tourists. Included are transient room taxes, resort community taxes, restaurant and car rental taxes.*

[6] *Natural resource related revenues include mineral lease payments and centrally assessed property taxes levied on natural resource properties. Not included are centrally assessed taxes on utilities or severance taxes on minerals remitted directly to the State's General Fund.*

- The potash resources of the socioeconomic study area are relatively unique. The Intrepid Potash mine near Moab (located on private property) is one of three locations for potash production in Utah, which is one of only three States in the nation that produce potash.

- The Intrepid Potash mine currently employs 50 persons. For the 2013 tax year, Grand County levied a total of $1,106,152 in property taxes on the Intrepid operation. For 2013, San Juan County levied $333,440 in property taxes on the Intrepid operation. Intrepid Potash paid no Federal mineral royalties, as it does not operate on Federally owned mineral estate. The State of Utah has no severance tax for potash.

- Applications for permits to drill oil and gas wells in the two Counties decreased significantly after 2008, but have rebounded through 2013. Over this same period, oil production increased substantially in Grand County (primarily due to Fidelity's production in the Big Flat area of Grand County), and increased somewhat in San Juan County. Gas production decreased in both Counties.

- As of early April, 2014, there were 24 producing oil and gas wells on Federal minerals in the Planning Area. Although these wells represent a relatively small percentage of all wells in the two Counties, they represent a substantial share of production and associated mineral lease payments, especially in Grand County. For the 12 month period ending February, 2014, mineral lease payments to Grand County totaled $2,100,958, an increase of 218 per cent over the prior equivalent period. Almost all this increase in production and mineral lease payments is associated with recently developed wells in the Big Flat area of Grand County, which is located within the Planning Area. San Juan County experienced a three percent decline in mineral lease payments to $1,172,675, with most production occurring outside the Planning Area.

- Estimates of employment and income effects of the development (drilling and completion) and production phases for oil and gas wells are possible using basic assumptions on development costs and production values along with the IMPLAN economic impact model. A range of estimates for the economic impacts of drilling one well are provided in the report. Economic impacts of both phases will be addressed in the impacts analysis phase of the planning process.

- In general, visitation at major natural resource sites (e.g., National Parks) in the socioeconomic study area increased through the period from 2005 to 2013. This indicates that visitation to major natural resource-based attractions provides a relatively recession-proof base of economic activity for the study area.

- Based on BLM data, estimated recreational visitation to BLM-administered lands in the Planning Area in 2011 totaled 803,636 visits, or 568,837 visitor days.

- The economic impacts of this level of recreation use were estimated using market segment and visitor expenditure data from a National Visitor Use Monitoring study of the Moab Field Office, and the IMPLAN model. The day use market segment for visitation to BLM lands within the Planning Area generated an estimated 19 jobs and $0.7 million in labor income. The non-local camping market segment generated 101 jobs and $4.4 million in labor income. The non-local lodging market segment generated 781 jobs and $20.9 million in labor income. Not all of these economic impacts, particularly for the camping and lodging segments, should be attributed to BLM

public lands only. Visitors to BLM sites in the socioeconomic study area often visit other attractions (such as National Parks) on the same trip[7].

- Socioeconomic impacts of the alternatives for the Moab MLP/EIS to BLM lands and realty program are likely to be limited. One activity that could be impacted is commercial filming permits. This activity is economically important; across the Moab Field Office in 2010, it generated an estimated 98 jobs and $1.2 million in labor income.

- BLM public lands in the Planning Area undoubtedly have nonmarket values that, while difficult to quantify, are important to recognize in making planning decisions about BLM public lands management.

- Tribal uses of BLM lands in the Planning Area exist and are important to recognize in planning.

The various factors and characteristics noted above are key drivers that affect management of BLM public resources. Many additional factors addressed in this *Socioeconomic Baseline Report* also impact use and management of these resources. Analysis of the alternatives for the Moab MLP/EIS will take into account these many considerations in order to assess the potential social and economic impacts of the alternatives.

[7] *This analysis is based on 2011 data; economic impacts of recreation and tourism with updated data will be addressed further in the impacts analysis phase of the planning process.*

3.12 SOIL AND WATER

3.12.1 Soils

Resource Overview

Stable and productive soils provide the foundation for other resources and for resource uses. Soils are the medium for plant growth, and provide nourishment for nearly all terrestrial organisms, supporting a wide variety of plant and animal communities within the Planning Area. Soils are derived primarily from the geologic formations that occur throughout the Planning Area as well as from materials washed down by rivers and streams, and windblown sands and silts known as loess, residuum, colluvium, alluvium, aeolian sands, and loess.

Soils are linked to nutrient and hydrologic cycles, energy flows, and other ecological processes and can have well developed biological soil crusts. Biological crust communities can provide significant protection from wind and water erosion. Disturbance of biological crusts affects most soils, some more than others, depending on the type of soil and biotic community.

Soils in the Planning Area are diverse; great differences in soil properties can occur within short distances. The distribution and occurrence of soils is dependent on a number of factors including the interaction of relief (slope), aspect, parent material (geology), living organisms, and climate. These variables create complex and diverse soil patterns that influence the use and management of the soil resource.

Soil temperature regimes predominantly vary from mesic (moderate, mean annual soil temperatures are 46 to 59 °F) at lower elevations to cryic (cold, mean annual soil temperatures are less than 46 °F, and they don't warm significantly in the summer) at higher elevations. Soil moisture ranges from aridic (very dry) to ustic (dry, but with some moisture in the growing season) throughout the Planning Area, with hydric (wet) soils occurring in riparian and wetland areas.

Surface disturbing uses may affect soil conditions and decrease overall soil health and productivity for a period of time. Soils are affected by a variety of surface uses that loosen topsoil, damage or remove vegetation or other ground cover, and/or create compaction layers which may result in accelerated erosion. The larger, more extensive disturbances will cause larger, longer term impacts.

Indicators of degraded soil conditions include increased water and wind erosion rates, loss of soil stability, decreased floodplain stability, increased gullying, increased compaction levels, decreased infiltration rates, reduced biological soil crust development, and decreased or loss of soil productivity.

Sensitive Soils

There are a variety of soil types in the Planning Area, including soils that are sensitive in nature such as moderately saline and highly erodible soils. Sensitive soils need special management to protect these soils from accelerated erosion and associated degradation. These soils may be especially vulnerable to impacts and harder to reclaim or restore after disturbance. Once these soils are disturbed, the impact usually is long-lasting. Table 3-19 describes the sensitive soil parameters as defined in the RMPs (BLM 2008a, 2008b). Map 3-23 shows the sensitive soil locations within the Planning Area.

Table 3-19. Sensitive Soil Parameters as defined in the RMPs (BLM 2008)

Factors	High Risk	Moderate Risk	Low Risk	Restrictive Feature
Erodibility				
Kw Factor (surface layer) and Slope (sl)	K≥.37, sl≥10%; or K=.20-.36, sl>30%	K=.20-.36, sl 10-30%; or K<.20, sl>30%	K<.20, sl 10-30%; or sl<10%	Water erosion
Wind Erodibility Group (surface layer)	1, 2	3, 4, 4L	5-8	Wind erosion
Limits on Reclamation				
Available Water Capacity (avg to 40"; in/in)	<0.05	0.05 - 0.10	0.10 <	Droughty soils
Salinity (mmhos/cm; surface layer)	16 <	8 - 16	< 8	Excess salt
Sodium Absorption Ratio (surface layer)	13 <	4 - 13	< 4	Excess sodium
Depth to Bedrock or Hardpan (inches)	< 10	10 - 20	20 <	Rooting depth
Alkalinity (pH of surface layer)	9.0 ≤	7.8 - 8.9	< 7.8	Excess alkalinity

Other sensitive soil areas, as defined in the RMPs (BLM 2008a, 2008b), include dust blowout /dust sink areas that were identified by USGS during extreme drought conditions in 2002 as shown on Map 3-24 and slopes greater than 30 percent as shown on Map 3-25.

Wind Erodible Soils

There are soils in the Planning Area that are more susceptible than others to wind and water erosion. Although these soils have naturally high rates of erosion, the erosion rates are easily accelerated by surface-disturbing activities. Best management practices to protect soil stability include interim reclamation, mulching bare ground with natural materials, limiting or seasonally restricting surface-disturbing activities such as grazing, off-road travel, oil and gas and mineral exploration and development especially during drought conditions.

Wind can strip the surface horizon of soil and nutrients necessary for seed germination and plant recruitment. Soils are especially susceptible to wind erosion when plant cover and/or biological soil crust cover are removed. A well-developed biological soil crust can prevent soil movement during high wind events, especially when interspersed between shrubs. Increases in wind erosion rates increase regional dust production, which can affect regional snow melt conditions.

Soil erodibility depends on the size distribution of soil particles and their ability to form stable macro- and micro-aggregates. Soil particles coalesce and form aggregates in interaction with soil organic matter. Sandy loam and sandy soils with low organic matter content develop aggregates with weak bonds and are thus the most erodible [by wind]. Fine textured soils, in turn, often develop stable and strong aggregates resistant to wind erosion. Any soil that is dry and pulverized is, however, susceptible to erosion. Under these conditions, particle removal [by wind] is the order of: clay>silt>fine sand, decreasing with increase in particle size" (Blanco and Lal 2008).

In the Planning Area, highly wind erodible soils occur on 119,862 acres (BLM only) and moderately wind erodible soils occur on 378,180 acres (BLM only) as shown on Map 3-26. Highly wind erodible soils are

soils within wind erodibility groups 1 and 2, while moderately wind erodible soils are within wind erodibility groups 3, 4, and 4L (as assigned in SSURGO database).

Wind Erosion and Fugitive Dust

Increased dust levels are national and regional concerns, as higher dust levels in higher elevations can cause earlier and faster snow melt events. Earlier snow melts can cause earlier peak flows, and can impact aquatic species that need peak flows later in the season.

An implication of wind-borne sediment is its effect on snowpack in downwind mountain ranges and ultimately, on water yield to the Colorado River and its tributaries. Airborne dust that collects on mountain snow decreases snow reflectance and accelerates spring snowmelt. For example, in 2009, the San Juan Mountains experienced heavy fallout from spring dust storms; even though the snow pack was average, spring snow melt was the earliest on record at 50 days earlier than normal (Painter et al. 2010). Painter et al. (2010) modeled the impacts of dust on snow to estimate its contribution to changes in runoff in the Upper Colorado River Basin during the timeframe 1916–2003. They found that while modeled natural flow peaked in June and produced runoff into July, post-disturbance (present day) runoff increased in April, peaked in May, and dropped off in June.

The models indicate that dust is reducing the flow on the Colorado River by five percent (two times the annual allotment for Las Vegas). Early snowmelt from accumulated dust (26–50 days) is greater than that predicted for temperature and precipitation changes from climate change (5–15 days). The authors believe that regional efforts at dust abatement and soil stabilization could have a mitigating effect on the runoff response of the Upper Colorado River as well as on future regional impacts of climate change (Bryce 2012).

Water Erodible Soils

Water, in the form of rain or overland flow from a rain or snow event, can cause accelerated soil movement from disturbed soils through the formation of rills and gullies, which then contributes to excess sedimentation in streams and reservoirs. Soils with higher Kw factors (an erodibility constant assigned to each soil unit in SSURGO database) and on steeper slopes have a higher potential for increased erosion when disturbed especially when disturbed during wet soil conditions.

Within the Planning Area there are approximately 20,600 acres (BLM only) of soils with high water erosion ratings and 37,237 acres (BLM only) of soils with moderate water erosion ratings as shown on Map 3-27. Soils with high potential for water erosion have slopes ten percent or greater and Kw factors greater than or equal to 0.37; or slopes greater than 30 percent and Kw factors between 0.20 and 0.36. Soils with moderate potential for water erosion have slopes between 10-30 percent and Kw factors between 0.20 and 0.36; or slopes greater than 30 percent and K-factors less than 0.20 (as assigned in SSURGO database).

Drought-Prone Soils

There are 36,252 acres (BLM only) of highly drought-prone soils and 20,236 acres (BLM only) of moderately drought-prone soils within the Planning Area as shown on Map 3-28. These soils have limited soil moisture retention; ratings are based on available water capacity factors which can affect revegetation and reclamation activities. Highly drought-prone soils have available water capacity levels less than 0.05 in/in and moderately drought-prone soils have available water capacity levels between 0.05 and 0.10 in/in.

These soil types and associated vegetation are severely impacted during drought conditions. Impacts to drought-prone soils from surface-disturbing activities can be reduced by using best management practices including minimizing construction activities during drought conditions and minimizing disturbed areas on drought-prone soils as much as possible.

Saline Soils

The Planning Area contains approximately 68,275 acres (BLM only) of moderately saline soils, mainly in Mancos Shale derived soils along the northern Planning Area, as shown in Map 3-29. Moderately saline soils have electrical conductivity levels between eight and 16 mmhos/cm. Soils with moderate salinity content have naturally high erosion rates and low reclamation potential. They are highly susceptible to surface disturbance, and erosion rates are easily accelerated. Erosion of saline soils impacts the water quality of downstream watersheds, raising salinity, selenium, and sediment loads and associated water chemistry parameters (TDS, Total Suspended Solids, etc.). The Total Maximum Daily Load (TMDL) prepared for the Colorado River in June 2014 cites the Mancos shale derived soils as a naturally occurring source of selenium, the pollutant causing the impairment for this water body.

Sodic Soils

Sodic soils are vulnerable to site degradation and are difficult to successfully revegetate. There are 277,902 acres (BLM only) of moderately sodic soils within the Planning Area as shown on Map 3-30. These ratings are based on Sodium Adsorption Ratio levels (SAR), which is the amount of sodium that can be held by the soils. This influences nutrient uptake. Highly sodic soils have a SAR value greater than 13, while moderately sodic soils have a SAR value between 4 and 13.

Shallow Soils

These soils are vulnerable to site degradation and are difficult to successfully revegetate. There are 181,276 acres (BLM only) of highly shallow soils and 75,499 acres (BLM only) of moderately shallow soils within the Planning Area as shown on Map 3-31. These ratings are based on soil depth to bedrock or hardpan. Highly shallow soils have a depth of less than ten inches to bedrock or a hardpan surface. Moderately shallow soils have a depth between ten inches and 20 inches to bedrock or a hardpan surface.

Alkaline Soils

Alkaline soils are vulnerable to site degradation and are difficult to successfully revegetate. A large percentage of the Planning Area contains alkaline soils, with 38,893 acres (BLM only) of highly alkaline soils and 574,305 acres (BLM only) of moderately alkaline soils found within the Planning Area as shown on Map 3-32. These ratings are based on pH levels measured in the surface layer. Highly alkaline soils have a pH of 9.0 or greater. Moderately alkaline soils have a pH between 7.8 and 8.9.

Dust Blowout/Dust Sink Areas

After the extensive drought in 2002, the USGS mapped 4,210 acres (BLM only) of "dust blowout areas" in the Moab Field Office (Map 3-24). These dust blowout/dust sink areas are discrete areas with actively blowing dust features such as active dunes or ripples and little to no vegetation. Often these areas are historic sheep bedding areas or areas surrounding heavily used water sources. During drought conditions, these areas can contribute large quantities of dust during high wind events. Under normal conditions, these areas are dominated by invasive and exotic plant species and lack soil productivity and stability.

Steep Slopes

Surface disturbances, such as road or well pad construction and large truck traffic, on steep slopes can increase erosion and surface runoff rates. There are 79,045 acres (BLM only) of steep slopes (slopes greater than 30 percent) within the Moab portion of the Planning Area as shown on Map 3-33. On lands within the Moab Field Office, a timing limitation stipulation for surface-disturbing uses is applied on slopes greater than 30 percent, prohibiting activities from November 1 to April 30.

There are 42,399 acres (BLM only) of steep slopes (slopes greater than 40 percent) and 29,150 acres of moderately steep slopes (slopes between 20 and 40 percent) within the Monticello portion of the Planning

Area as shown on Map 3-34. In lands within the Monticello Field Office, new surface-disturbing activities are not allowed on slopes greater than 40 percent; surface-disturbing activities on slopes between 21-40 percent require an erosion control strategy, reclamation and site plan with a designed approved by the BLM prior to construction.

Both seasonal restrictions on surface-disturbing activities and erosion control plan requirements can minimize impacts to steep slopes.

Biotic Soil Crusts

Biotic soil crusts are made up of mats or filaments of cyanobacteria, lichens and mosses. Development of biotic soil crust is strongly influenced by soil texture, soil chemistry, and soil depth. Crusts are more developed in shallow, sandy, non-saline soils, but can also be found throughout saline soil areas. They tend to be commonly found associated with soils high in gypsum. Soil crust species richness varies by soil type and parent material, with species richness higher on gypsiferous soils, non-calcareous sandy soils, and limestone-derived soils. Many of the vegetative communities found in the Planning Area have evolved with the presence of biological soil crusts.

Biotic soil crusts play a major role in reducing water and wind erosion and in preventing the establishment of invasive annual grasses. They fix atmospheric nitrogen and carbon, retain soil moisture, and provide surface cover. Crust composition and level of abundance can be used to determine the ecological history and condition of a site (BLM 2001).

Loss of biotic soil crust leads to reduced soil productivity, decreased plant cover and vigor, and increased wind and water erosion. Severity, size, frequency, and timing of a surface-disturbing activity affect the degree of impacts to biotic soil crusts. Fine-textured soils have faster crust recovery rates than coarse-textured soils (BLM 2001). "Soil crust populations are degraded when mechanical disturbances such as vehicular traffic, land clearing, or trampling disturb the soil surface. While any of these disturbances may not directly eliminate soil crusts, repeated disturbance degrades and fragments crust cover and may keep it in an early successional state" (Belnap et al. 2001, Bryce 2012).

Although soil crusts can be found throughout the Planning Area, there are areas with high density or well-developed crusts or unusual crust components. Areas with higher potential for high density or well-developed crusts include Pinyon-Juniper woodland areas and shallow sandy areas associated with Slickrock and rock outcrops.

Monitoring and Assessments

Monitoring and assessment of soil conditions in the Planning Area is mainly conducted on a project level to provide the BLM with information on impacts and restoration successes on a project specific level. The BLM is currently working with the USGS Southwest Biological Center to conduct monitoring in relation to several recent seismic projects within the Planning Area. These ongoing monitoring efforts will help to determine the short and long term impacts of different techniques on different soil types. For example, detailed studies have been initiated on highly wind erodible soils to determine whether off road travel is less impacting when multiple vehicles use the same tracks or when multiple vehicles travel side by side.

Other ongoing monitoring activities include qualitative soil assessments as part of the Rangeland Health Assessments (RHA) associated with grazing permit renewals. These studies are conducted at long term study sites established by BLM's grazing program.

There are several grazing exclosures within the Planning Area located on sensitive soil units, some constructed over 30 years ago and some constructed within the last decade. These exclosures provide an

opportunity to evaluate the level of grazing impacts outside the exclosures as compared to current conditions within the grazing exclosures. The BLM is currently working with the USGS, Southwest Biological Science Center, to gather detailed soil and vegetation condition information both outside and within these exclosures.

A large fuels reduction project was implemented on Shay Mesa several years ago, in the southern portion of the Planning Area, involving extensive removal of pinyon-juniper woodland. Baseline information was collected by the BLM fuels staff on soil and vegetative resources in and near the treatment area. Soil monitoring efforts are ongoing to assess the short and long term changes in erosion and in biological crust communities in and near this vegetation treatment.

3.12.2 Water Resources

Surface Water Resources

Introduction

Surface water resources are important in this arid region, and support other resources and uses within the Planning Area including riparian vegetation, wildlife habitat, wildlife use, grazing use, recreation use, municipal public drinking water supplies, and private drinking water sources. Water quality varies based on parent rock properties, local conditions, and uses. Water quantity varies seasonally with higher stream flows in the spring from snowmelt, low flows in the late summer, and sporadic high flows in late summer and fall from large thunderstorms. Changes in either water quality or water quantity can affect associated ecological factors including wildlife habitat, floodplain stability, and vegetation.

Surface water can be found in rivers, streams, springs, seeps, ponds, and reservoirs. Groundwater flows to the surface at many isolated springs and seeps, and is the source of most stream flows in the Planning Area. Changes to groundwater conditions such as water quality or quantity can affect surface water conditions over time. Likewise, groundwater resources can be affected by surface water conditions, as they are recharged by infiltration of snowmelt, rainwater and sometime stream flows.

Resource Overview

Surface waters within the Planning Area include the Colorado River, the Green River, perennial and intermittent streams, and many springs and seeps. There are numerous stock ponds and reservoirs within the Planning Area to provide water to stock and wildlife. Many surface waters have water rights associated with their uses and water rights are managed by the State of Utah.

The 100-year floodplains of all perennial, intermittent, and ephemeral drainages are important components of the surface water system, as they provide needed drainage for stormwater and large flash floods within the Planning Area. It is important to allow stormwater to flow through the drainage system without accelerated erosion and/ or sedimentation. Unstable conditions can add to the naturally sediment-rich hydrologic systems, causing water quality impairments within the Colorado River Basin.

Both the BLM and the UDEQ conduct monitoring of surface water resources within the Planning Area, including collection of water chemistry and macro-invertebrate samples. Using this monitoring data, UDEQ determines the conditions of these water resources by completing detailed assessments and submits this information to the U.S. EPA every two years in the Integrated Report or Utah's List of Impaired Waters. Currently the Colorado River and Fisher Creek (tributary to the Dolores River) are the only water bodies in the Planning Area that have been determined by the Utah Division of Water Quality (UDWQ) to be impaired and not meeting State standards. However, three additional water bodies have been added to UDWQ's 2014 303(d) list of impaired waters: Kane Springs Wash, Mill Canyon Wash (tributary of

Courthouse Wash), and North Cottonwood Creek. EPA has not yet made a final decision on UDWQ's recommendation.

Rivers

The Green River is located along the western edge of the Planning Area for almost 60 miles, with its headwaters in Wyoming and northern Utah. Stream flows are dam controlled, with the Flaming Gorge Dam located over 100 miles upstream of the Planning Area. Streamflows have been measured by the USGS near the town of Green River Utah since 1894, just upstream of the Planning Area. The average base flow in the Planning Area is about 3,000 cubic feet per second (cfs), with average daily stream flows ranging from 2,300 cfs in late August to 17,000 cfs in late May. In June of 1917, stream flow at this site peaked at 68,000 cfs.

The Green River flows into Canyonlands National Park immediately to the south of the Planning Area and joins the Colorado River about 50 river miles downstream of the Planning Area. When these two major rivers join the stream flow is often doubled. This section of the Colorado River is referred to as Cataract Canyon and is a popular section for river runners.

The Colorado River flows through the middle of the Planning Area, for about 40 miles, with its headwaters in western Colorado. It then flows into Canyonlands National Park immediately to the south and west of the Planning Area. Stream flows are also dam controlled, with a large diversion upstream of Glenwood Springs Colorado and several diversions near Grand Junction Colorado. Streamflows are measured by the USGS just upstream of the Planning Area near Dewey Bridge. The average base flow in the Planning Area is 3,000 cfs in January, with average high water flows about 23,000 cfs in June. In 1894 peak stream flow was estimated at 125,000 cfs, which is significantly higher than any other peak stream flow measured at this site. The next highest peak stream flow measurement was 76,800 cfs in 1917. More recently, peak stream flow at this site in 1984 was 70,300 cfs.

The Dolores River is a large tributary to the Colorado River, joining the Colorado River just upstream of Dewey Bridge, just upstream of the northern Planning Area boundary. Although the Dolores River does not flow through the Planning Area, it does drain the northeast area including Cottonwood Canyon- Fisher Creek and Waring Canyon. Stream flow on the Dolores River is measured by the USGS about ten miles upstream of the confluence with the Colorado River. Stream flows upstream of the confluence with the San Miguel River are restricted by the McPhee Dam near Norwood Colorado.

Streams

Within the Planning Area there are 64 miles of perennial streams and stream segments which flow year round, and 136.5 miles of intermittent streams and stream segments which flow for over 30 days continuously. These streams drain the Planning Area and flow into the Colorado, Green, or Dolores Rivers. These streams are mainly fed by springs and seeps, enhanced seasonally by snowmelt and flood flows. Those streams within the Courthouse Wash and Salt Wash watersheds flow immediately into Arches National Park and then downstream to the Colorado River. The perennial and intermittent stream segments by watershed within the Planning Area are listed in Table 3-20 and are shown on Map 3-35.

Table 3-20. Miles of Perennial and Intermittent Stream Segments by Watershed

Watershed	Stream	Perennial	Intermittent
Courthouse Wash	Bartlett Wash	0.5	4.5
Courthouse Wash	Hidden Canyon	0	1.5
Courthouse Wash	Tusher Canyon	0.5	2

Watershed	Stream	Perennial	Intermittent
Courthouse Wash	Mill Canyon	0	1.5
Courthouse Wash	Courthouse Wash	0	2
Courthouse Wash	Seven Mile Wash	0	3
Granite Creek- Lower Dolores River	Fisher Creek	11	0
Granite Creek- Lower Dolores River	Waring Canyon	0	2
Granite Creek- Lower Dolores River	Hideout Canyon	0	1
Harts Draw	Harts Draw	0	12
Hatch Wash- Kane Springs	Kane Springs	10	10.5
Hatch Wash- Kane Springs	Trough Springs	2	1
Hatch Wash- Kane Springs	Hatch Wash	6	9
Hatch Wash- Kane Springs	Goodman Canyon	0.5	1
Hatch Wash- Kane Springs	Unnamed	0	4
Hatch Wash- Kane Springs	Muleshoe Canyon	0	4
Hatch Wash- Kane Springs	Hunter Canyon	0	6
Hatch Wash- Kane Springs	Troutwater Springs Canyon	0	2.5
Hatch Wash- Kane Springs	Unnamed	0	1
Hatch Wash- Kane Springs	West Coyote Wash	0	5
Hatch Wash- Kane Springs	Three Mile Creek	0	3
Hatch Wash- Kane Springs	Little Water Creek	0	2.5
Hatch Wash- Kane Springs	Hatch Ranch Wash	0	2
Hatch Wash- Kane Springs	Windwhistle Draw	0	3.5
Indian Creek	Indian Creek	13	2
Indian Creek	North Cottonwood Creek	14	0
Lockhart Canyon- Colorado River	Day Canyon	0	1.5
Lockhart Canyon- Colorado River	Unnamed	1	0
Sagers Wash	San Arroyo Wash	0	1
Sagers Wash	Owl Draw	0	0.5
Salt Wash	Lost Spring Canyon	1	0
Salt Wash	Yellow Cat Wash	1	0
Salt Wash- Green River	White Wash	0	7
Salt Wash- Green River	Red Wash	0	3.5
Salt Wash- Green River	Unnamed	0	3.5
Taylor Canyon- Green River	Spring Creek	0	8
Taylor Canyon- Green River	Mineral Canyon	0	6
Taylor Canyon- Green River	Unnamed	0	0.5
Ten Mile Canyon	Ten Mile Wash	3.5	14
Ten Mile Canyon	Cow Canyon	0	0.5

Watershed	Stream	Perennial	Intermittent
Ten Mile Canyon	Freckles Canyon	0	1
Ten Mile Canyon	Trail Canyon	0	1
Ten Mile Canyon	Trough Canyon	0	2

Springs/Seeps

Springs and seeps are important sources of water in isolated areas, providing water for wildlife, grazing, and recreationists as well as supporting riparian vegetation and wildlife habitats. These water sources are directly related to groundwater and are affected by changes to groundwater water quality conditions or flow conditions. Spring flows often have seasonal and annual variations with a delayed response to recharge conditions. This delay may be short term, with quick responses to drought conditions, or may be long term, taking years to show any changes. The major springs within the Planning Area are listed in Table 3-21 and are shown on Map 3-36.

Table 3-21. Major Springs within the Planning Area

Name	Location
Little Mountain Spring	T24S R18E sec 12
Deadman Spring	T25S R18E sec 9
Dripping Springs- Lockhart Basin	T28S R20E sec 27
Dry Oak Spring	T22S R21E sec 26
Hart Spring	T31S R22E sec 1
Hatch Ranch Springs	T29.5S R22E sec 35
JC Park Spring	T26S R21E sec 10
Lost Spring	T23S R22E sec 17

Little Mountain Spring

Little Mountain Spring is a small spring located in an alcove in the northwest portion of the Planning Area. Flows fluctuate seasonally, with higher flows in the spring and lower flows in the late summer/ early fall. Flows can be as low as 0.5 gpm. The BLM holds a Federal diligence claim and a State-appropriated water right on this spring for stock and wildlife uses established in 1903 and 1878 respectively. A public water reserve (PWR) was established around this spring to protect public uses.

Deadman Spring

Deadman Spring is a small spring located in the northwest portion of the Planning Area. There are actually several small seeps within 1000 feet of the main spring, in adjacent alcoves. Flows fluctuate seasonally, with average flows of two gpm in the winter/ early spring going to just a seep in the summer/ fall months. This spring seems to be flowing at a geologic bedding contact expressed on a small cliff face.

Dripping Springs - Lockhart Basin

Dripping Springs is located in Lockhart Basin on the western edge of the Planning Area. This is a small isolated spring with very low flows and little associated riparian vegetation.

Dry Oak Spring
Dry Oak Spring is a small spring in the northern portion of the Planning Area. Flows at this site average less than two gpm in the winter and early spring months, and often is dry in the summer and fall months. Flow from the spring is captured in a reservoir for stock to use in the winter. This spring seems to be stratigraphically controlled, seeping out of a sandstone layer in an alcove. The BLM holds a Federal diligence claim on this spring for stock and wildlife uses established in 1879.

Harts Spring
Harts Spring is a large spring in the southern portion of the Planning Area. This spring flows year round and provides water in Harts Draw for a mile or more. Two PWRs were established to protect water for public uses at this spring and just downstream of the spring.

JC Park Spring
JC Park Spring is located along the Colorado River just downstream from Moab. This isolated spring flows from a sedimentary bedding contact, with average flows fluctuating from three gpm in the winter and early spring months to almost no flow in the late summer and fall months. A PWR has been established at this spring to protect water for public uses. The BLM holds a Federal diligence claim or water right on this spring for stock and wildlife uses established in 1890. At one time, this spring was developed to provide water for a BLM campground. This system was decommissioned in the 1990s.

Lost Spring
Lost Spring is a small spring in an alcove in the northern portion of the Planning Area. This spring fluctuates seasonally with average flows ranging from two gpm in winter and early spring months to nearly no flow in late summer and fall months. The BLM holds a Federal diligence claim or water right on this spring for stock and wildlife uses established in 1879.

Spring Areas
The springs and seeps located in the Planning Area are influenced by geologic stratigraphy and/or geologic structures such as faulting and fracturing. Sometimes there are isolated springs, but often there are a number of springs in an area that could be hydrologically connected by the geologic setting.

A hydrologic analysis of the spring areas may be necessary in order to determine the potential impacts to the springs prior to conducting mineral operations. This analysis may include a description of the geology and potentially affected aquifers and springs along with a drilling plan that demonstrates how water resources would be protected. A water monitoring plan may also be necessary.

These spring areas within the Planning Area are described in the text below, and are listed in Table 3-22 and shown on Map 3-36.

Table 3-22. Spring Areas within the Planning Area

Name	Location
Bartlett Wash Springs Area	T24S R19-20E
Cave Springs Area	T23S R23E
Seven Mile Wash Springs Area	T25S R20E
Crystal Springs Area	T23S R18S
Day Canyon Springs Area	T26S R20E
Hatch Wash Springs Area	T29S R22E
Horsethief Springs Area	T26S R18E

Name	Location
Lower Kane Creek Springs Area	T26S R21E
Upper Kane Creek Springs Area	T27S R22E
Ten Mile Canyon Springs Area	T24S R18E
Trough Springs Area	T27S R21E
Troutwater Springs Area	T28S R21E
White Wash Springs Area	T23S R17E
Yellow Jacket Springs Area	T23S R23E

Bartlett Wash Springs Area

The Bartlett Wash Springs Area includes over ten springs and seeps within a several-mile radius, all located on or near the northern side of the Moab Fault. This area is within the Courthouse Wash Watershed, which has been identified by Arches National Park as ecologically important spring system located along the western boundary of Arches National Park.

After extensive hydro-geologic studies conducted by the National Park Service and the State of Utah, it is clear that the springs in the Bartlett Wash Area are hydrologically connected and ecologically important to springs located in Arches National Park. The source of water for the spring system is the Entrada aquifer which is defined as the Slick Rock Member of the Entrada Sandstone, the Moab Member of the Curtis Formation, and all other rock units lying above the Moab Member of the Curtis Formation to and including the ground surface.

The recharge area for the springs in Arches National Park is the portion of Courthouse Wash Watershed located on the east side of the Moab Fault. This is a shallow aquifer system with a relatively short travel time of about 50 years (Hurlow and Bishop 2003). The Moab Fault is considered a groundwater barrier, so any withdrawals to the northwest of the Moab Fault may not impact the spring system in Arches National Park.

The springs in the Bartlett Wash Springs Area and in Arches National Park are highly vulnerable to any contamination and/or withdrawals of groundwater from the Moab Member aquifer. In May 2015, NPS and the State of Utah finalized a water-rights agreement that protects water resources for administrative uses and in situ uses in Arches National Park. Administrative and in situ uses include but are not limited to providing water for riparian and wetland vegetation and ecosystems; hanging gardens; geomorphologic processes; wildlife habitat and watering; and other uses that shall satisfy and promote the scenic, conservation, preservation, protection, recreational, and other purposes for which the Park was established. According to the Agreement, the State of Utah recognizes and establishes a Protection Zone to protect the flow of perennial, intermittent, and ephemeral streams, seeps, springs, and other naturally occurring water within the Park whose source is surface water or groundwater from the Entrada aquifer. Geologic units below the Entrada aquifer are not included in the Protection Zone. The Protection Zone is comprised of the area from the ground surface to the base of the Entrada aquifer in portions of the Courthouse Wash, Sevenmile Canyon, and Salt Wash drainage basins.

The recharge area for the Bartlett Wash Springs Area is the Bartlett Flat area to the southwest. Base flows for these springs range from 5-20 gallons per minute (gpm). Several PWRs have been established in this area to protect water resources for public use.

Seven Mile Wash Springs Area
An ecologically important spring system has been identified by Arches National Park which is located along the western boundary of Arches National Park. This spring system includes several springs on BLM lands as well as springs within the National Park, and provides base flows in Seven Mile Wash and Courthouse Wash.

After extensive hydro-geologic studies, it is clear that these springs in Seven Mile Wash Spring Area are hydrologically connected and ecologically important to springs in Arches National Park. The source of water for the spring system is the Moab Member aquifer, which is a well sorted, calcite-cemented, densely jointed aeolian sandstone.

The recharge area for the springs in Arches National Park is the portion of Courthouse Wash Watershed located on the east side of the Moab Fault. This is a shallow aquifer system with a relatively short travel time of about 50 years (Hurlow and Bishop 2003). The Moab Fault is considered a groundwater barrier, so any withdrawals to the northwest of the Moab Fault would not impact the spring system in Arches National Park.

The springs in the Seven Mile Wash Spring Area and in Arches National Park are highly vulnerable to any contamination and/or withdrawals of groundwater from the Moab Member aquifer. In May 2015, NPS and the State of Utah finalized a water-rights agreement that protects water resources for administrative uses and in situ uses in Arches National Park as described under Bartlett Wash Springs Area.

Cave Springs Area
The Cave Springs Area includes three springs and seeps within a 1 mile radius. These springs are located in alcoves or narrow side canyons, seeping out from sandstone layers. The spring flows fluctuate seasonally with base flows of less than five gallons per minute (gpm).

Crystal Springs Area
The Crystal Springs Area includes several springs within a one-mile radius that are located along or on the southwestern edge of the Moab Fault. These springs fluctuate seasonally, ranging in flows from ten gpm to no flow in late summer. The springs provide water to a large area with no other surface water resources.

Day Canyon Springs
There are several seeps and springs near the mouth of Day Canyon located near the center of the Planning Area, flowing both from alcoves and seeps in the canyon bottom. These springs fluctuate seasonally, ranging in flows from ten gpm in winter and early spring to no flow in late summer. The BLM holds a Federal diligence claim or water right on these springs for stock and wildlife uses established in 1879.

Hatch Wash Springs Area
The Hatch Wash Springs Area is located in the southern portion of the Planning Area, and includes at least six springs in Hatch Wash, Hatch Ranch Wash, Little Water Canyon, Three Mile Canyon and Goodman Canyon. This cluster of springs may be structurally controlled with a stratigraphic component. These springs provide variable stream flow to these creeks, with higher flows in the winter and early spring months and low flows during the late summer and fall months.

Horsethief Springs Area
The Horsethief Springs Area includes several springs and seeps within a one mile radius and is located in alcoves or small canyons. These springs fluctuate seasonally, ranging in flows from ten gpm to no flow in late summer. The springs provide water to a large area with no other surface water resources.

Lower Kane Creek Springs Area
There are several springs and seeps in the lower mile of Kane Creek Canyon and the lower reaches of Hunter Canyon which can provide up to a total of 100 gpm of water to Kane Creek. These springs seem to be structurally controlled with a stratigraphic component and do not fluctuate very much seasonally. There are multiple water rights filed on these springs by the BLM for use by stock and wildlife.

Upper Kane Creek Springs Area
The upper section of Kane Creek, near U.S. 191 at the Hole 'n Rock, is a spring area with substantial flows accumulating in Kane Creek. The Kane Springs Rest Area, operated and maintained by the Utah Department of Transportation, has developed a public drinking water system at the rest area, providing good quality water to travelers year round. Immediately downstream of the rest area there are large springs located on BLM lands which contribute an average of two cfs to Kane Creek. Additional springs and seeps contribute additional stream flow to Kane Creek for another mile or so.

These springs and seeps are hydrologically connected and are an important water source in this area. Multiple PWRs were established in this area to protect public uses of these water resources.

Ten Mile Canyon Springs Area
The Ten Mile Canyon Springs Area includes several springs and seeps in both the main canyon and tributaries within the Ten Mile Wash ACEC. The ACEC was established as an ACEC in the 2008 Moab RMP based on relevance criteria including scenic, cultural, wildlife, natural processes, and natural hazards. All the relevance criteria are enhanced or influenced by perennial pools, springs and seeps, and perennial and intermittent stream segments within the canyon.

Water maintains the ecological diversity in this area by supporting a rich mixture of riparian resources and well-developed wetlands. The source of these springs and seeps is groundwater discharge. Springs and seeps provide water to perennial to intermittent pools and stream segments scattered throughout the area.

Trough Springs Area
The Trough Springs Area includes at least five springs and several seeps within two miles of each other, along the rim of Trough Springs Canyon. The location of these springs is influenced by the geologic structures and faults in the area. Base flows at these springs have not been monitored but are expected to be in the range of 10 to 50 gpm, and may fluctuate seasonally. These springs are important surface water sources for the northern Hatch Point area, with only one spring within ten miles.

Troutwater Springs Area
The Troutwater Springs Area includes two springs and several seeps within Troutwater Canyon in the southern portion of the Planning Area. These springs have stream flows that vary seasonally, with flows less than ten gpm during the winter and early spring seasons and less than one gpm during the late summer and fall months. A PWR was established surrounding Troutwater Spring to protect the use of water by the public.

White Wash Springs Area
The White Wash Springs Area involves several springs and many springs and seeps, located in White Wash and tributaries as well as under an extensive sand dune area. The springs and seeps at the surface provide the only surface water within almost ten miles, with base flows ranging from one to 20 gpm. The springs located under the sand dune area provide water for isolated cottonwood trees in an unusual ecological setting.

Yellow Jacket Springs Area

The Yellow Jacket Springs Area includes several springs and seeps located in Yellow Jacket Canyon, a Slickrock wash with little soil or vegetation. Although these springs and seeps have very low flow, barely measurable, they do provide the only surface water resources for miles.

100-year Floodplains

Washes and their associated floodplains convey stormwater runoff through the watersheds to the Colorado, Green or Dolores Rivers. Each wash or drainage has an adjacent floodplain which is essential to convey stormwater runoff, especially during large precipitation events. The 100-year floodplain is the floodplain that conveys stormwater runoff for a 100-year flood event, a flood event that has a 1 percent probability of occurring in any given year. Based on the expected 100-year flood flow rate in a given drainage, the 100-year floodplain is the area of inundation. The locations of these 100-year floodplains vary depending on topography, floodplain and channel profile (widths, depths).

Decisions were made in the 2008 RMP to restrict surface-disturbing activities within these 100-year floodplains to reduce impacts to stream bank stability and therefore reducing accelerated erosion rates and associated sedimentation loading to the Colorado River Basin. These 100-year floodplains have not been delineated at this time, but can be delineated by an engineer at the time of a site specific project proposal.

Current Status and Trends

Natural processes and human actions influence the chemical, physical, and biological characteristics of surface water which can vary seasonally. Indicators of water quality include, but are not limited to:

- Chemical characteristics (e.g., pH, conductivity, dissolved oxygen, dissolved solids, salinity)
- Physical characteristics (e.g., suspended sediments, temperature, and turbidity)
- Biological characteristics (e.g., macro-invertebrate communities, bacteria levels, algae and fish species).

Indirect indicators of water quality conditions and watershed health include the riparian assessments using the PFC assessment and/ or multiple inventory monitoring techniques.

Surface Water Quality

Potential concerns with water quality within the Planning Area can include high stream temperatures, low dissolved oxygen levels, high sediment loads, high nutrient levels, and high levels of TDS, salinity, and high coliform bacteria levels. High stream temperatures and low dissolved oxygen levels are associated with low stream flow conditions, but can be due to lack of riparian vigor and shading. High sediment loads are often associated with natural flood events, but can be increased by surface disturbances upstream in the watershed.

Salinity

High salinity levels in surface waters are a water quality concern of national significance recognized in the Colorado River Basin Salinity Control Act of 1974. Salinity contributions are from both point sources and nonpoint sources. During low flow periods, salt contribution comes solely from point sources including seeps, springs, and groundwater flow. During high flow periods, non-point sources, including erosion of saline soils, become major contributors to salinity problems.

Point sources of salinity within the Planning Area include discharge of saline groundwater from natural springs, seeps, flowing wells, and gaining streams. These small and isolated saline springs and seeps are not hydrologically connected to the Colorado River and do not affect the overall water quality conditions in the Colorado River.

The primary nonpoint sources of salinity in the Planning Area are the diffuse overland runoff from saline soils and erosion and transport of saline soils during flow events. The Mancos Shale is recognized as the largest contributor of nonpoint salinity in the Upper Colorado River Basin (Laronne 1977). There are approximately 78,941 acres of moderately saline, Mancos Shale-derived, soils in the northern portion of the Planning Area. Any surface disturbance on these soils increases erosion and associated salinity and sediment loading to the Colorado River Basin, especially when the soils are wet and easily compacted.

Another potential source of salinity in the Colorado River is seepage from the potash evaporation ponds near the center of the Planning Area. These evaporation ponds were constructed on private land in the 1960s with older construction techniques and appear to have some seepage on the surface. BLM staff have observed small salt seeps surrounding the ponds and throughout the washes from the ponds to the Colorado River. These seeps and springs may contribute salinity loads to the Colorado River, although there is currently no documentation of this situation.

Monitoring

Water resource monitoring activities include stream flow measurements (Map 3-37). In addition, water chemistry sampling, and aquatic habitat assessments including macro-invertebrate sampling are collected. These sample locations are shown on Map 3-38.

Stream Flows: The USGS monitors stream flows and water quality conditions of the Colorado River at the northeast boundary of the Planning Area near the Dewey Bridge. Stream flow measurements began in 1913. Water quality parameters measured include specific conductivity, suspended sediment concentrations and water temperature, with the data available on the web in real time (http://waterdata.usgs.gov/ut/nwis/nwisman/). Specific conductivity data collection began in 2006 and is still ongoing. Suspended sediment concentrations were measured from 1941 to 1984 and are not currently measured at this site. Water temperature data collection began in 2006 and is ongoing. An additional monitoring location is located outside the Planning Area near the potash plant on private land.

The USGS also monitors stream flows and water quality conditions of the Green River 15 miles upstream of the Planning Area near the Green River State Park, with stream flow measurements beginning in 1894. Water quality parameters measured include specific conductivity, suspended sediment concentrations and water temperature readings. These data are available on the web in real time (http://waterdata.usgs.gov/ut/nwis/dv?referred_module=sw&site_no=09315000). Suspended sediment concentrations were measured from 1949 to 1894 and are not currently measured at this site. Specific conductivity data collection began in 1961 continuing through 2013. Water temperature measurements were collected from 1950 through 2013. Currently only stream flows are recorded at this site.

The USGS installed a new stream gauge on the Green River at Mineral Bottom in the spring of 2014, located about 50 miles downstream of the stream gauge near Green River State Park and approximately 35 miles downstream of the Planning Area boundary. This stream gauge will collect stream flows and suspended sediment concentrations, and is supported by the National Park Service to better understand the suspended sediment regime in Canyonlands National Park and Glen Canyon Recreation Area downstream as well as in Lake Powell and in the Grand Canyon further downstream.

Water Chemistry: The BLM coordinates closely with the UDEQ regarding water quality sampling, participating in a cooperative program in which the BLM collects water chemistry samples and field data and the UDEQ provides lab analysis and database management. UDEQ also collects water chemistry samples and field data during their intensive sampling efforts every five years or so. Water quality sample sites within or near the Planning Area are shown on Map 3-38 and include sites along Kane Creek, Indian Creek, North Cottonwood Creek, Spring Canyon, Ten Mile Wash, and White Wash. Pre- 2012 data are

available online in the STORET database (http://www.epa.gov/storpubl/). Data from 2012 to present will be available online in the State of Utah database in the near future.

Aquatic Habitat Assessments: The BLM has conducted macro-invertebrate sampling on perennial streams within the Planning Area including Kane Creek, Spring Canyon Creek, and Ten Mile Wash. This information was collected following the National Aquatic Monitoring Center (NAMC) sampling protocols. Data analysis including species identification was provided by NAMC and may be used in future aquatic habitat assessments. The USGS Biological Sciences Center conducted more detailed aquatic habitat assessment and water quality sampling work in Ten Mile Canyon in and around the perennial pools and spring areas in 2012.

Condition Assessments

Recent water quality condition assessments were assigned by UDEQ as part of the 2010 Integrated Report to EPA. Portions of the Indian Creek Watershed are in assessment category 2A, which includes areas where State standards are being met for the parameters assessed. The Kane Springs Wash Watershed and the Salt Wash Watershed are both in assessment category 3A, which includes areas that are not sufficiently assessed and need more data (Map 3-39).

Impaired Waters/ TMDL Reports

With sufficient data, UDEQ can determine if a stream is meeting State standards. If a problem is documented, that stream segment will be included by the State of Utah on the List of Impaired Waters of Utah (303d list) submitted to the EPA every two years. A schedule for a TMDL is set. This study determines how to reduce pollutants and restore all beneficial uses. The TMDL also establishes the amount of a pollutant allowed in the water.

The only water bodies within the Planning Area determined by UDEQ to be impaired are the Colorado River, which was listed in 2010 for impairment to the selenium standard and Fisher Creek as a tributary to the Dolores River which were listed in 2010 for impairment to the TDS standard.

A TMDL for the Colorado River was approved by the State of Utah, Division of Water Quality, in June 2014. The selenium levels are already high and above Utah State standards near the Colorado-Utah State line, where the Colorado River enters Utah. Upstream in the Grand Valley, the Gunnison Valley, and Montrose areas of Colorado are high contributions of selenium from irrigation and development on Mancos Shale related soils. There are several private farming operations upstream of the Planning Area; irrigating Mancos Shale related soils in Utah that may be contributing additional selenium to the Colorado River.

Surface Water Uses and Water Rights

Surface waters within the Planning Area are mainly used by livestock and wildlife. Surface waters are also used for domestic, irrigation, municipal and industrial purposes. The State of Utah administers the water rights program, managing water uses throughout the Planning Area. There are currently 351 approved water right applications for the use of surface waters on BLM lands, either from water developments such as a spring box or a stock pond, or directly from the water body or stream. The locations of these water rights and uses are shown on Map 3-40a.

There is one potash mining operation within the Planning Area which obtains water directly from the Colorado River for their operations, diverting about 15 cfs a day. This mine is a solution mine which pumps water from the Colorado River into the underground potash production zone. This water is used to dissolve the potash minerals and the brine is then pumped to the surface and put into evaporation ponds. When the water has evaporated the potash minerals are collected and processed.

Public Water Reserves

PWRs are Federally reserved water rights created by executive orders and are designed to reserve natural springs and water holes on public lands for general public use. A PWR designation is a Federally reserved water right as well as a land withdrawal. There are 8,878 acres of PWRs within the Planning Area as shown on Map 3-41. To date, many of these PWRs have not been registered with the State and/or are not adjudicated.

Until 1926, PWRs were created on an ad hoc and site-specific basis. Federal agencies identified the springs they wanted reserved and these springs were incorporated by executive order into a chronologically numbered PWR. Therefore PWRs with early numbers refer to site- specific reservations. In 1926, a carte blanche PWR was created through an executive order by President Coolidge titled "Public Water Reserves No. 107." PWR 107 ended the site-specific system of reserving springs and water holes. The purpose of PWR 107 was to reserve natural springs and water holes yielding amounts in excess of homesteading requirements. The order states that "legal subdivision(s) of public land surveys which is vacant, unappropriated, unreserved public land and contains a spring or water hole, and all land within one quarter of a mile of every spring or water be reserved for public use." There was no intent to reserve the entire yield of each public spring or water hole, but rather reserved water was limited to domestic human consumption and stock watering. All waters from these sources in excess of the minimum amount necessary for these limited public watering purposes are available for appropriation through State water law.

BLM decisions made in the 2008 RMP include a no surface occupancy requirement for all PWRs which applies to oil/gas leasing and development and other surface-disturbing activities.

Groundwater Resources

Introduction

Groundwater resources vary in quality, quantity, and depths throughout the Planning Area. Groundwater is the source of water for most streams, springs, and seeps in the Planning Area, supporting riparian resources and wildlife habitat. Groundwater wells within the Planning Area provide water to livestock, wildlife, recreation users, while adjacent water wells are important sources of public drinking water.

Changes to groundwater conditions such as water quality, quantity, or depth can affect surface water resources over time. Likewise, groundwater resources, recharged by infiltration of snowmelt, rainwater, and sometime stream flows, can be affected by surface water conditions and climatic variations.

Resource Overview

Groundwater occurs in important unconsolidated aquifers adjacent to the Planning Area and in potential unconsolidated aquifers within the Planning Area (Map 3-42). Groundwater also occurs in six consolidated rock aquifers within the Planning Area; the aerial extent of these consolidated aquifers is shown on Maps 3-43 through 3-47. The consolidated aquifers, in descending order, include the Dakota aquifer, the Morrison aquifer, the Entrada aquifer, the Glen Canyon Group aquifer, the Cutler Formation aquifer, and the Lower Paleozoic aquifer system. The potential unconsolidated aquifers include Quaternary-age sediments such as stream and alluvial fan deposits scattered throughout the Planning Area.

Shallow unconfined aquifers can be found throughout the Planning Area, with the highest potential for large quantities of good quality water are in the southern portion of the Planning Area, in the Entrada Aquifer within the Hatch Point area.

There are several public drinking water systems in and near the Planning Area which draw water from groundwater aquifers including unconsolidated sediment aquifers, the Entrada aquifer, and the Glen Canyon Group aquifer.

Due to evaporate deposits in the Paradox Formation underlying much of the Planning Area, there is a significant occurrence of briny groundwater at deeper levels. TDS concentrations can exceed 10,000 milligrams per liter (mg/L).

The following discussion of aquifers and confining units within the Planning Area is based on a report prepared for BLM's Moab MLP area by the USGS in 2014 (USGS 2014). Groundwater is considered suitable for drinking water with 3,000 mg/L or less of total dissolved solids and that do not exceed State and Federal groundwater-quality and health standards. Underground Sources of Drinking Water (USDW) are defined to include aquifers with a concentration of Total Dissolved Solids (TDS) less than 10,000 mg/L and with a quantity of water sufficient to supply a public water system. Aquifers are presumed to be USDWs unless they have been specifically exempted or if they have been shown to fall outside the definition of USDW (e.g., over 10,000 mg/L TDS).

Unconsolidated Aquifers

Unconsolidated sediments are found throughout and adjacent to the Planning Area in valley bottoms and in thin zones on bedrock. Several of these unconsolidated sediment zones adjacent to the Planning Area are important sources of water for Moab City and the Town of Castle Valley. These valley-fill unconsolidated aquifers in Moab-Spanish Valley and Castle Valley are discussed in detail below. Smaller and less extensive unconsolidated sediment packages are found throughout the Planning Area in wash bottoms or valley fill material. These deposits can act as aquifers, providing water to springs and seeps in wash bottoms. There is little information on these potential aquifers available at this time in relation to flow, storage and water quality. The aerial extent of these potential aquifers can be seen on Map 3-42.

Valley-Fill Aquifer/Moab- Spanish Valley

A valley-fill aquifer can be found in the Moab-Spanish Valley area, adjacent to but not within the Planning Area. This aquifer consists of unconsolidated Quaternary deposits and is currently the principal source of irrigation water in the Moab area. Water from this valley-fill aquifer has slightly poorer water quality than the Glen Canyon aquifer, with higher levels of TDS. Transmissivity rates range from low to high depending on local conditions. Due to a lack of an impermeable layer above the valley-fill aquifer, this aquifer is considered to be a shallow unconfined aquifer.

This aquifer is in direct contact with the lower Glen Canyon Group aquifer (USGS 2014), which provides the majority of recharge as subsurface flow from the northeast side of Spanish Valley. Discharge from this aquifer is to springs, water wells, streams, and wetlands within the Moab-Spanish Valley area.

Valley-Fill Aquifer/Castle Valley

A valley-fill aquifer is also found in Castle Valley, adjacent to but not within the Planning Area, and has similar characteristics as the valley-fill aquifer in Moab-Spanish Valley. This aquifer is unconsolidated alluvial sediments deposited in the Castle Valley lowlands and is also considered a shallow unconfined aquifer. Most residents in Castle Valley use water from this aquifer for domestic, irrigation and stock uses. The Town of Castle Valley provides drinking water to some residents from this aquifer.

Recharge to this aquifer is mainly from seepage from Castle and Placer Creeks, with their headwaters in the La Sal Mountains to the south of Castle Valley. Minor components of recharge include infiltration through sediments from precipitation or irrigation, or inflow from the Cutler aquifer on the southwest side of Castle Valley.

Consolidated Aquifers and Confining Units

Dakota Aquifer

The Dakota aquifer consists of consolidated rocks of the Dakota Sandstone and the Burro Canyon Formation. This aquifer is classified as having low to moderate transmissivity rates, with higher rates in faulted or fractured areas. Recharge to the aquifer is likely from infiltration from precipitation that falls on Dakota Sandstone outcrop. The aquifer discharges to low flow seeps and springs within the Planning Area. The Dakota aquifer is not contiguous east of the Colorado River as seen on Map 3-43. Groundwater samples collected from wells completed in the Dakota aquifer had total dissolved-solids concentrations ranging from 98 to 1,800 mg/L.

Morrison Aquifer

The Morrison aquifer consists of consolidated rocks of the Salt Wash Member of the Morrison Formation, with low transmissivity rates similar to the Dakota aquifer. Recharge and discharge conditions are similar to the Dakota aquifer. Discharge may contain high concentrations of radio-nucleides due to high quantities of uranium found in the Morrison Formation. Discharge can also be slightly saline. In certain places, there is no confining layer between the upper Morrison aquifer and the lower Entrada aquifer, and there can be discharge from the Morrison aquifer to the Entrada aquifer. The aerial extent of this aquifer can be seen on Map 3-44. Groundwater samples collected from wells completed in the Morrison aquifer had total dissolved-solids concentrations from 517 to 25,700 mg/L. The groundwater typically has high radionuclide activity because of large quantities of uranium within the formation.

Tidwell-Summerville Confining Unit

The Tidwell-Summerville confining unit consists of the Summerville Formation and the Tidwell Member of the Morrison Formation and separates the Entrada and Morrison aquifers. The units are composed of shale and siltstone interbedded with sandstone and chert. The confining unit ranges in thickness from 0 to 400 feet within the Planning Area. The confining unit is considered to have very low permeability and is a barrier to vertical groundwater movement.

Entrada Aquifer

The Entrada aquifer consists of consolidated rocks of the Moab Member of the Curtis Formation and the Slick Rock Member of the Entrada Formation, with moderate transmissivity rates. This aquifer has also been referred to as the San Rafael Group. Shallow groundwater samples collected from the Entrada aquifer had total dissolved-solids concentrations ranging from 119 to 417 mg/L.

Recharge is mainly from infiltration from precipitation falling on Entrada outcrop areas or where porous sediments overlie the outcrop. Discharge from the aquifer goes to numerous seeps and springs within the Planning Area, as well as leaking into the lower Glen Canyon Group Aquifer. This is a common production zone for water wells, with good water quality and quantity. The aerial extent of the aquifer can be seen on Map 3-45, absent only in the far western portion of the Planning Area.

The BLM recognizes that the Entrada aquifer is near the surface with no confining layer above it in most of the southern half of the Planning Area, and considers it a shallow unconfined aquifer. This makes the aquifer very sensitive to contamination from the surface which could affect water quality in water wells, springs, and seeps.

Dewey Bridge Confining Unit

The Dewey Bridge confining unit consists of the Dewey Bridge Member of the Carmel Formation/Entrada Sandstone and separates the Glen Canyon Group and Entrada Aquifers. The Dewey Bridge Member is composed of sandstone and siltstone of contorted bedding. The Dewey Bridge confining unit only occurs across the north and northwest of Grand County, Utah, where it ranges in thickness from 0-150 feet. This unit is considered to have very low permeability and is a barrier to vertical groundwater movement.

Glen Canyon Group Aquifer

The Glen Canyon Group aquifer consists of consolidated rocks of the Glen Canyon Group consisting of the Navajo Sandstone, Kayenta Formation, and Wingate Sandstone, and can be up to 1,000 feet thick. Moderate transmissivity rates are common throughout the aquifer, enhanced greatly by fracturing in places. The Kayenta Formation can act as a confining layer in places, due to lithologic characteristics. The aquifer is present in most of the Planning Area as seen on Map 3-46.

Recharge primarily occurs as infiltration from precipitation in the upland outcrop areas and is higher in areas with highly fractured rock, or in outcrop areas covered with permeable sandy soils, or from leakage from the overlying Entrada aquifer. Recharge can also come from infiltration of surface water from streams traveling over outcrop areas.

Discharge from this aquifer can be found at numerous springs, seeps, and streams within the Planning Area. This a common production zone for water wells in the central and southern portions of the Planning Area, with good water quality and quantity.

This aquifer is the principal source of water for most groundwater wells drilled in southern Grand County. Total dissolved-solids concentrations for groundwater samples collected from the aquifer range from 102 to 827 mg/L.

Lower Mesozoic Confining Unit

The Lower Mesozoic confining unit consists of the Moenkopi Formation, a brown shale, mudstone, arkosic sandstone, and conglomerate with local beds of gypsum, and the Chinle Formation which is comprised of reddish siltstone, sandstone, mudstone, and conglomerates. The confining unit ranges in thickness from 0 to 1,000 feet in the Planning Area and thickness generally increases from south to north and east to west. This unit is considered to have very low permeability and is a barrier to groundwater movement except where jointed, faulted, or fractured.

Cutler Formation Aquifer

The Cutler Formation aquifer consists of the Honaker Trail Member of the Hermosa Formation and the highly permeable Cedar Mesa and White Rim Sandstones of the Cutler Formation (Map 3-47). Transmissivity rates are mainly determined by lithologic characteristics, but are greatly enhanced by fractures and solution chambers in the Honaker Trail section.

Recharge to this aquifer is from precipitation infiltrating through soils in the upland areas, especially in areas with shallow sand deposits or where the formations are highly fractured. This aquifer discharges to numerous seeps, small springs and small streams within the Planning Area. Adjacent to the Planning Area, the aquifer is the source of water for groundwater wells completed within the Needles District of Canyonlands National Park and in Castle Valley. Total dissolved-solids concentrations in groundwater-quality samples collected from the aquifer ranging from 270 to 6,010 mg/L.

Upper Paleozoic System

The Upper Paleozoic system consists of the Paradox Member of the Hermosa Formation. Groundwater from this unit is highly saline and typically shows high total dissolved-solids concentrations of greater than 35,000 mg/L, and often more than 100,000 mg/L. This system which occurs with the oil and gas and potash deposits does not provide usable water for drinking or irrigation. However, this brine can be used in solution mining of potash deposits.

Lower Paleozoic Aquifer System

The Lower Paleozoic aquifer system of sedimentary rocks is laterally continuous throughout the Planning Area. This aquifer includes the Lynch Dolomite, the Elbert Formation Limestone, the McCracken Sandstone Member of the Elbert Formation, the Ouray Limestone, and the Leadville Limestone and its

equivalents including the Redwall Limestone. In most of the Planning Area, this aquifer system occurs at depths greater than 4,000 feet.

Thicknesses of up to 1,800 feet have been measured for the aquifer in drill holes located near the confluence of the Green and Colorado Rivers. Transmissivity rates are variable and are controlled by secondary porosity features such as fractures, faults, and solution channels or caverns. Recharge is from outside the Planning Area where the formations outcrop at the surface. Total dissolved-solids concentrations from groundwater-quality samples range from 7,172 to 379,469 mg/L.

Current Status and Trends

Shallow Unconfined Aquifers

An aquifer is considered to be shallow if it is located at or near the surface, at least within several hundred feet of the surface. An aquifer is considered to be unconfined if there is no layer above the aquifer to restrict infiltration into or discharge from the aquifer, such as three feet of clay soils or an impermeable rock layer. Certain aquifers are both shallow and unconfined, and are highly susceptible to contamination from the surface. These shallow unconfined aquifer systems are permeable rock or unconsolidated sediment layers located near the ground surface elevation containing water, with no confining or impermeable layer on top to restrict water movement to or from the surface.

There are several shallow unconfined aquifer systems within the Planning Area, including the extensive Entrada aquifer and the smaller unconsolidated sediment aquifers. These shallow unconfined aquifers are extremely vulnerable to contamination from the surface. Since there is no impermeable layer between the surface and the aquifer, contaminants can easily move from the surface into the aquifer. Contaminants can be introduced to these unconfined aquifers through disposal ponds, evaporation ponds, or accidental spills.

The most important shallow unconfined aquifer system in the Planning Area is the Entrada aquifer. This aquifer is near the surface in most of the southern portion of the Planning Area, with no confining layer to protect it from surface contamination. The Entrada Aquifer contains large quantities of high quality water in the Hatch Point area, and provides drinking water to the Wilson Arch Resort Community Drinking Water System adjacent to the Planning Area.

The smaller and less extensive unconsolidated sediment aquifers are also located at the surface with no confining layer above to restrict infiltration and potential contamination. Where the Glen Canyon Group aquifer is located at the surface, there is potential for shallow unconfined aquifer conditions depending on local lithologic conditions.

Best management practices that can protect these shallow unconfined aquifers from contamination include lining disposal ponds, leak detection systems under larger disposal ponds, avoiding construction of evaporation ponds, minimizing buried pipelines as much as possible, erosion and storm water run-off control measures, and spill prevention and countermeasure plans.

Groundwater Uses and Water Rights

Groundwater in the Planning Area is utilized for livestock grazing, wildlife, and public and private drinking water. There are 129 water wells that provide water for livestock and wildlife in troughs and ponds. There are 180 water wells that provide public and private drinking water within the Planning Area.

Drinking Water

Groundwater resources in the Planning Area are important drinking water sources for several public water sources on BLM and private lands within and adjacent to the Planning Area, domestic water wells on State and private lands, and irrigation on private lands. Groundwater feeds Indian Creek and the associated municipal diversion for the City of Monticello just south of the Planning Area.

There are two Sole Source Aquifers located adjacent and to the northeast of the Planning Area. Neither of these Sole Source Aquifers are located within the Planning Area. The Glen Canyon Sole Source Aquifer is the source of drinking water for the City of Moab and Spanish Valley. The Castle Valley Sole Source Aquifer is the source of drinking water to the Town of Castle Valley.

There are four public drinking water systems with six water sources (water wells) within the Planning Area. The Utah Division of Drinking Water (UDDW) approves "public drinking water source protection zones" for each public drinking water source or water well.

Sole Source Aquifers

Sole source aquifers are designated by EPA on the request of the drinking water supplier, and are aquifers which supply at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas can have no alternative drinking water sources that could supply those who depend upon the aquifer for drinking water. The Planning Area is directly adjacent or close to two Sole Source Aquifers that provide drinking water to the Moab-Spanish Valley area and Castle Valley.

The Sole Source Aquifer designation petition for the Glen Canyon Aquifer System was filed by the City of Moab in May 2001. The City of Moab obtains all its drinking water from the Glen Canyon Aquifer System, from four springs and five water wells. Another potential water supply is the Valley Fill aquifer in Spanish Valley; however, due to its poor water quality, it is not considered a viable source of water. Because the Glen Canyon Aquifer system is exposed at the surface within the delineated Drinking Water Source Protection Zones, it is not protected from potential contaminants spilled on the ground. The aquifer is also vulnerable to contamination introduced through poorly constructed oil wells and test holes in the area.

The Sole Source Aquifer Designation Petition for the Castle Valley Aquifer System was filed with EPA in August 2001. The Castle Valley Aquifer System serves as the sole source of drinking water for residents of Castle Valley, with no alternative drinking water source that could provide 50 percent or more of the area's drinking water needs. Most residents have individual water wells that pump water from quaternary alluvium/valley fill or from the underlying fractured Cutler Formation. The unconsolidated Valley Fill aquifer is the most important source of good quality drinking water; however, it is most susceptible to contamination. Recharge is partially from the La Sal Mountains. Potential sources of contamination include petroleum and mineral exploration, geophysical drilling, accidental spills along roadsides, and upward migration of lower quality water from bedrock aquifers through man-made conduits.

Public Drinking Water Systems/ Drinking Water Source Protection Zones

Overview

The Safe Drinking Water Act (SDWA) is the main Federal law that ensures the quality of Americans' drinking water, passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources including rivers, lakes, reservoirs, springs, and groundwater wells.

Under the SDWA, EPA sets standards for drinking water quality and oversees the States, localities, and water suppliers who implement those standards. The EPA has given Utah primacy, or responsibility, for enforcing the Federal act within the State of Utah. To qualify for this primacy, Utah's laws and rules governing public drinking water systems must be at least as strict as the Federal law.

Although the SDWA applies to all public drinking water systems, it does not apply to or regulate private wells which serve fewer than 25 individuals. A "public drinking water system" is legally defined as any drinking water system (publicly or privately owned) which serves 15 or more connections, or 25 or more people at least 60 days out of the year.

All public water systems are further categorized into three different types: Community, Non-transient, Non-community, and Transient Non-community. These categories are important with respect to required monitoring and water quality testing found in Utah State Rules.

- A Community Water System (C) is a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

- A Non-Transient Non-Community Water System (NTNC) is a public water system that regularly serves at least 25 of the same nonresident persons per day for more than six months per year.

- A Transient Non-Community Water System (TNC) is a non-community public water system that does not serve 25 of the same nonresident persons per day for more than six months per year.

Each public drinking water system is permitted and regulated through the UDDW. These regulations require that each public drinking water supplier prepare a source protection plan for each of its groundwater sources. This plan must be reviewed and approved by the Division of Drinking Water.

Typically, a plan is developed after a hydro geological evaluation is conducted for each source. The investigation determines what areas must be protected, and the extent of protection which is necessary. Within these protection zones, various activities or facilities may be restricted if they will jeopardize the purity of the drinking water source.

These plans delineate four source protection zones or management areas around each drinking water source (Map 3-48):

- Zone one is the area within a 100-foot radius from the wellhead or margin of the collection area.

- Zone two is the area within a 250-day groundwater time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the groundwater source, or the groundwater divide, whichever is closer.

- Zone three is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the groundwater source, or the groundwater divide, whichever is closer.

- Zone four is the area within a 15-year groundwater time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the groundwater source, or the groundwater divide, whichever is closer.

The plans may delineate two source protection zones or management areas around each Transient Non-Community drinking water source instead of the four protection zones described above.

- Zone one is the area within a 250 day groundwater time of travel from the wellhead or margin of the collection area.

- Zone two is the area within a ten year travel time to the wellhead or a margin of the collection area.

Providers of public water may choose instead to use the Optional 2-mile Radius Delineation Procedure to delineate a management area instead of the protection zones described above. This procedure is best applied in remote areas where few, if any, potential contamination sources are located.

Resources

There are four public drinking water systems located within the Planning Area, with a total of six water sources, as listed in Table 3-23 and shown on Map 3-48. Within two miles of the Planning Area boundary there are an additional ten public drinking water systems with a total of 13 water sources, as listed in Table 3-24 and shown on Map 3-48.

Table 3-23. Public Drinking Water Systems and Sources within the Planning Area

Water System Name	System Type	Water Source	Location
Archview Resort Campground	Transient Non-Community (TNC)	Well #1	T24S R20E sec 35
Canyonlands Field	Non-Transient Non-Community (NTNC)	Runway Well #3	T23S R20E sec 31
Canyonlands Field	NTNC	Hanger Well #2	T24S R20E sec 06
Windwhistle Campground	TNC	Windwhistle Well	T30S R22E sec 13
Wilson Arch Resort Community	NTNC	Well #1	T29S R23E sec 15
Wilson Arch Resort Community	NTNC	Well #2	T29S R23E sec 22

Table 3-24. Public Drinking Water Systems and Sources within Two Miles of the Planning Area

Water System Name	System Type	Water Source	Location
Arches National Park- HQ	TNC	Well #1	T25S R21E sec 21
Bucks Grill	TNC	Well #1	T25S R21E sec 26
Canyonlands National Park - Needles District HQ	TNC	Cave Springs Well	T30S R20E sec 20
Canyonlands National Park - Needles District HQ	TNC	Well #2	T30S R20E sec 20
Day Star Adventist Academy	Community	Artesian Well	T25S R23E sec 8
Grand County- Matrimony Spring	TNC	Matrimony Spring	T25S R21E sec 27
Kane Springs Highway Rest Stop	TNC	Well #1	T28S R22E sec 1
Kane Springs Highway Rest Stop	TNC	Well #2	T28S R21E sec 1
Kane Springs Highway Rest Stop	TNC	Spring #1	T28S R21E sec 1
Moab City	Community	Skakel Spring	T25S R21E sec 36
Red Cliffs Ranch	TNC	Ranch well	T24S R22E sec 35
Slickrock Campground	TNC	Well #1	T25S R21E sec 26
Wilson Arch Resort Community	NTNC	Well #3	T29S R23E sec 22

BLM Instruction Memorandum UT- 2010-055 describes the responsibility of the BLM to ensure that usable groundwater zones, including Drinking Water Source Protection Zones, are protected through review and analysis of an application for permit to drill, and during subsequent drilling and completion operations.

These "Drinking Water Source Protection Zones" identified by UDDW are the same zones as the EPA refers to as "Groundwater Protection Zones."

Water Wells

Water wells are another important source of water in isolated areas, used by wildlife, livestock, and recreationists (see Public Drinking Water Systems section). These wells access relatively shallow groundwater resources and are affected by changes to groundwater water quality conditions or flow conditions. Water levels in wells often have seasonal and annual variations with a delayed response to recharge conditions. This delay may be short term, with quick responses to drought conditions, or may be long term, taking years to show any changes. The 18 major water wells within the Planning Area are listed in Table 3-25 and are shown on Map 3-49.

Table 3-25. Major Water Wells within the Planning Area

Name	Location
Dubinky Well	T24S R18E sec 25
Eight Mile Rock Well	T29S R21E sec 14
Levi Well	T23S R18E sec 25
Monument Wash Wells (2)	T22S R22E sec 15
Queens Well	T23S R19E sec 18
Three Mile Well	T29S R22E sec 30
Mail Station Well	T30S R23E sec 8
Tank Draw Well	T30S R23E sec 22
West Division Well	T30S R23E sec 30
Lloyd Adams Well	T31S R23E sec 5
Lightning Draw Well	T31S R23E sec 3
Lone Cedar Draw Well	T31S R23E sec 18
Harts Draw Well	T32S R23E sec 7
Hart Point Well No. 2	T31S R22E sec 4
Hart Point Well No. 1	T31S R22E sec 6
Hart Point Well No. 3	T31S R22E sec 25
Hart Point Well No. 4	T30S R22E sec 31
Photograph Gap Well	T31S R23E sec 21

Water Rights for Groundwater Resources

The administration of water rights is the responsibility of the Utah State Division of Water Rights. There are a total of 891 active water right applications filed on water sources, both groundwater and surface water sources, within the Planning Area. The BLM has 351 approved water right applications on water sources located on BLM lands. These water rights are used for livestock, wildlife, domestic, irrigation, and municipal purposes. Map 3-40b delineates the locations and uses of active water rights within the Planning Area.

Monitoring

Groundwater monitoring is occurring within the Planning Area and is conducted by the USGS Division of Water Resources. This involves measuring artesian or pumped flows, stream temperatures, and water chemistry parameters on select water wells in the Planning Area. These wells are revisited on a regular basis, over a period of several years. The USGS has sampled the water well at the Windwhistle Campground several times in the last decade. There were no concerns about the water quality conditions based on this sampling program.

There are several shallow groundwater monitoring wells maintained by the U.S. DOE at the north end of the Moab Valley at the Atlas Mill Tailings Site, located at the edge of the Colorado River and adjacent to the Planning Area. There are multiple hazardous contaminants in the shallow groundwater at this location, sourced in the tailings pile, including radio-nucleides, ammonia and heavy metals. A long term project to move these tailings is underway, containing and moving the contaminants to the Crescent Junction area far away from water resources. Contaminated groundwater moves from the tailings site into the Colorado River via shallow groundwater flows.

Basic monitoring of the public drinking water wells within and adjacent to the Planning Area is ongoing, coordinated by the State of UDDW. This monitoring involves monthly testing for coliform bacteria and less frequent testing of sulfate and nitrate levels.

Additional groundwater monitoring within or adjacent to the Planning Area may be necessary if large groundwater withdrawals are approved by the State of Utah in the future.

3.13 SPECIAL DESIGNATIONS: AREAS OF CRITICAL ENVIRONMENTAL CONCERN

3.13.1 Resource Overview

FLPMA defines an ACEC as an area "within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards." There is no one method of management for all ACEC areas. Special management is designed specifically for the relevant and important values of each ACEC, and therefore varies from area to area. The one exception is that a mining plan of operation is required for any proposed mining activity that would create surface disturbance greater than casual use within a designated ACEC (43 CFR 3809 Regulations).

There are six ACECs that are entirely located within the Planning Area (Map 3-50). These ACECs are listed in Table 3-26 along with the associated acreage, relevant and important values, and Field Office.

Table 3-26. Areas of Critical Environmental Concern within the Planning Area

ACEC Name	Acreage (BLM)	Relevant and Important Values	Field Office
Behind the Rocks	3,911	Natural systems (threatened, sensitive and endangered plants), cultural resources, scenery	Moab
Highway 279/Shafer Basin/Long Canyon	12,626	Scenery, wildlife, natural systems(threatened, sensitive, and endangered plants), cultural resources	Moab
Indian Creek	3,894	Scenery	Monticello
Lavender Mesa	649	Relict Vegetation	Monticello
Shay Canyon	119	Cultural	Monticello
Ten Mile Wash	4,988	Natural systems (riparian/wetlands), wildlife, cultural and natural hazards	Moab

Below are descriptions of each ACEC and the relevance and importance criteria for which the ACEC was designated.

3.13.2 Description of Area and Relevance and Importance Criteria for Areas of Critical Environmental Concern

Behind the Rocks Area of Critical Environmental Concern (3,911 acres)

Description of Area: Behind the Rocks is located west of the city of Moab and east of Kane Creek Canyon (Map 3-50). It is an area of sandstone fins and deeply entrenched canyons, with arches and other features. The BLM-identified boundary of the ACEC was established to insure that all relevant and important cultural, wildlife, plant, and scenic resources were included.

Relevance Criteria: The ACEC contains significant cultural resources, including rock art and habitation sites. The scenic values are outstanding, with slickrock domes and fins present on a grander scale than those found in Arches National Park. There are several large natural arches found within the ACEC. The ACEC also contains habitat for several special status wildlife species, including the peregrine falcon, southwest willow flycatcher, spotted bat, and big free-tailed bat. Three special status plant species occur

within the ACEC; they include the Canyonlands biscuitroot, alcove rock daisy, and alcove bog orchid. The area is one of only three major population centers (and of these, the least imperiled) for the Canyonlands biscuitroot. Two narrowly distributed plants, the western hophornbeam and alcove death camas also occur. In addition, there are relict plant communities within the area that are valuable for scientific study.

Importance Criteria: Within the ACEC, cultural sites are distinctive and of special worth. Scenic values found in the ACEC are nationally significant; for instance, Behind the Rocks is the best example of Navajo sandstone fins in the world, and provides the scenic backdrop to the town of Moab. The rare and endemic plants in the ACEC are fragile, rare, and irreplaceable. Behind the Rocks is one of only 12 known areas with occurrences of the alcove rock daisy, and one of three areas in which the Canyonlands biscuitroot is found. The ACEC also contains plant communities and soils that have received little disturbance or alteration, providing an uncommon remnant of the pre-settlement landscape.

Highway 279/Shafer Basin/Long Canyon Area of Critical Environmental Concern (12,626 acres)

Description of the Area: The area is a corridor along Highway 279, including the extension road into the Shafer Basin (Map 3-50). The Shafer Basin forms the viewshed from Dead Horse Point State Park. In addition, Long Canyon to the Dead Horse Mesa is included in this ACEC. The boundary of the ACEC has been identified by the BLM to ensure that relevant and important values are included.

Relevance Criteria: The ACEC contains significant scenic, cultural, plant and wildlife resources. Highway 279, a State scenic byway, is located within the ACEC. The byway provides extraordinary scenery and ancient rock art that is enjoyed by thousands of visitors every year as they drive along the Colorado River. The Shafer Basin provides the spectacular foreground scenery as viewed from the road and from Dead Horse Point State Park. Long Canyon also provides a scenic backcountry drive just off Highway 279. The scenery is classified as visual resource managment Class I.

Jane's globemallow, a Utah BLM sensitive plant, is found in the Shafer Basin portion of the ACEC. The plant is both rare and unique and extremely susceptible to general human disturbance. In addition, both Shafer Basin and Long Canyon contain important habitat to the desert bighorn sheep. As a result of this vegetation, the uplands north of Dead Horse Point State Park contain significant values for wildlife and plants.

Importance Criteria: The ACEC includes spectacular scenery and cultural resources, and provides vegetation for wildlife. It is also habitat for the Jane's globemallow, a BLM sensitive species. The stunning scenery within Shafer Basin and Long Canyon as viewed from State Scenic Byway 279 and Dead Horse Point State Park is internationally renowned. Highway 279, Shafer Basin and Long Canyon are also venues for many film permits, due to their spectacular scenic backdrops.

The wildlife values meet the importance criteria as the Shafer Basin is primary habitat for desert bighorn sheep, which also utilize Long Canyon. These distinctive animals are unique and of more than local significance. It is the Shafer Basin habitat which enabled the dwindling desert bighorn herd to survive. This bighorn herd is one of only two indigenous native desert bighorn herds in the State of Utah, and the Shafer Basin herd has provided stock for restoring desert bighorns to other environments.

Indian Creek Area of Critical Environmental Concern (3,894 acres)

Description of Area: Indian Creek ACEC is located in the southern portion of the Planning Area, east of and adjacent to Canyonlands National Park/Needles District (Map 3-50). The Indian Creek ACEC buffers the scenic view from Needles Overlook across BLM land into Canyonlands National Park. The area

includes the lower end of Indian Creek and Rustler Canyon. The ACEC corresponds roughly with the Indian Creek WSA, but is slightly larger.

Relevance Criteria: The Indian Creek ACEC is noted for its incised, meandering canyons that wind through dark red mudstones, forming many rounded spires, and "hoodoos" (boulders atop eroded rock that look like mushrooms). These various formations continue uninterrupted into Canyonlands National Park, which contains some of the most unique landforms in the world. Visitors from around the world come to view this area from overlooks across BLM land and Canyonlands National Park.

Importance Criteria: The scenic values of the ACEC are based on the rock formations similar to those found in Canyonlands National Park. The area surrounding the ACEC has a visual resource management Classification I when viewed from the overlook; conversely, when viewed from the basin, the area appears less natural due to resource activities that have taken place within the basin. The area provides extensive scenic viewsheds seen from the eastern rims high above the area into Canyonlands National Park.

Lavender Mesa (Mesa Top Only) Area of Critical Environmental Concern (649 acres)

Description of Area: Lavender Mesa ACEC covers the top of Lavender Mesa, located in the Indian Creek corridor of the Planning Area (Map 3-50). Lavender Mesa is isolated and inaccessible to humans and herbivores by ground routes; even small mammals such as rabbits and mice appear to be absent. The mesa top supports a relict plant community environment. Most of the mesa is pinyon-juniper woodland with the exception of a small 20-acre sagebrush-grass park. The entire mesa is BLM-administered public land, and its boundary is high cliffs protecting the mesa top from access.

Relevance Criteria: The vegetative community present on the top of Lavender Mesa is unique because it has developed without the influence of grazing animals and most other mammals. The area is ecologically relevant because it presents an isolated, relict plant community that remains unaltered by human or animal intervention. The vegetative community is important as a baseline for comparative studies of pinyon-juniper woodland and sagebrush-grass communities in other parts of the Colorado Plateau.

Importance Criteria: The vegetative community is important for study and comparison purposes to design management for pinyon-juniper woodland and sagebrush-grass communities in other parts of the Colorado Plateau. The mesa offers an unimpacted area naturally protected from other resource activities. In a range of comparison of relict plant communities, Lavender Mesa provides a baseline area free from even small animals, while Bridger Jack Mesa provides an area protected from human activities, but with the presence of large and small mammals.

Shay Canyon Area of Critical Environmental Concern (119 acres)

Description of Area: Shay Canyon ACEC is located in the southern portion of the Indian Creek corridor and is adjacent to the northern boundary of the Manti–La Sal National Forest (Map 3-50). It includes sections of the upper Indian Creek drainage with a Special Emphasis Area for the protection of aquatic and riparian habitat, delineated as a 275-foot corridor along upper Indian Creek.

Relevance Criteria: Relevance/Cultural: Rock art sites covering the walls of Shay Canyon are the significant cultural resources along Indian Creek. Native Americans who have visited these sites recognize images that relate to their migration history.

Importance Criteria: Cultural resources in this area represent the interface between two prehistoric cultural groups: Ancestral Puebloan and Fremont. This interface is represented in the unique motifs in the

rock art and within site features and artifacts such as ceramics and baskets. The area provides an opportunity for cultural scientific research.

Ten Mile Wash Area of Critical Environmental Concern (4,988 acres)

Description of Area: Ten Mile Wash is located northwest of Moab; it drains into the Green River just downstream of White Wash and upstream of Spring Canyon (Map 3-50). The ACEC consists of the Ten Mile drainage from the Green River to two miles upstream of Dripping Spring.

Relevance Criteria: Ten Mile Wash ACEC is noted for its scenic, cultural, wildlife, and the natural systems or processes, as well as natural hazards that are found within the ACEC. Ten Mile Wash ACEC contains high-quality scenery related to sandstone buttes, cliffs, side canyons and alcoves; the scenery is enhanced by the presence of a riparian greenbelt that is located within the bottom of the canyon. Ten Mile Wash contains significant cultural resources, including important habitation sites and unusual artifacts.

Ten Mile Wash ACEC contains perennial and intermittent flows that maintain ecological diversity in upland and riparian/wetland areas. The wash provides a favorable environment for wildlife within an extremely arid portion of the Field Office. Ten Mile Wash contains a rich mixture of riparian, wetland and hydrologic resources. Perennial segments support well-developed wetlands that are rare and unusual in arid regions. Ten Mile Wash is subject to extreme flooding, posing potential safety hazards to vehicle and camping activities. The potential for flooding is great because the Ten Mile Wash watershed basin drains 175,185 acres.

Importance Criteria: This ACEC meets the importance criteria for cultural, wildlife values, natural systems or processes, and natural hazards. Cultural resources in Ten Mile Wash ACEC are of more than local significance, and are fragile, rare, and exemplary. Ten Mile Wash is a very important wildlife habitat because it offers water and habitat in the driest portion of the Planning Area. Ten Mile Wash contains textbook examples of areas with wetland potential. Riparian/wetland ecosystems in Ten Mile Wash are rare, sensitive resources vulnerable to degradation from surface disturbances. These wetland ecosystems are exemplary and rare; they serve as attractors for wildlife and for human activities, making the wash extremely susceptible to adverse impact. Riparian/wetland ecosystems are a national priority concern, and are managed for health and diversity as required by the Clean Water Act, Floodplain and Wetland Executive Orders, Rangeland Standards and Guidelines, and the National Riparian Area Policy. Ten Mile Wash contains extreme seasonal flooding potentials that warrant special management regarding public access and camping within the drainage.

3.14 SPECIAL DESIGNATIONS: NATIONAL HISTORIC TRAILS AND BACKWAYS AND BYWAYS

3.14.1 Introduction

National Historic Trails

National Historic Trails are "extended trails which follow as closely as possible and practicable the original route or routes of travel of national historical significance" (NPS 2009). The purpose of the National Historic Trails is "the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment" (NPS 2001).

The National Trails System Act of 1968 provides for the establishment of a system that includes recreational, scenic, and historic trails. A national historic extended trail must possess several qualities for designation as a national historic trail. The trail must be at least 100 miles in length and as closely as possible follow the original route. The trail must be established by historic use and be historically significant as a result of that use. The trail must be of national significance with respect to any of several broad categories of American history, such as trade and commerce, exploration, migration and settlement, or military campaigns. Finally, the trail must have significant potential for public recreational use or historical interest based on historic interpretation and appreciation.

In southern Utah the only National Historic Trail is the Old Spanish National Historic Trail (OSNHT), which was designated on December 4, 2002, by the Old Spanish Trail Recognition Act. The trail and its variants make up a 2,700-mile long route that extends from Santa Fe, New Mexico, to Los Angeles, California. The trail passes through the States of New Mexico, Colorado, Utah, Arizona, Nevada, and California. Approximately 43.2 miles of the OSNHT are located within the Planning Area (Map 3-51). Of these 43.2 miles, 28.8 are located on public lands.

National Scenic Byways

The National Scenic Byways Program was established under the Intermodal Surface Transportation Efficiency Act of 1991, and reauthorized in 1998 under the Transportation Equity Act for the 21st Century. Under the program, the U.S. Secretary of Transportation recognizes certain roads as National Scenic Byways or All-American Roads based on their archaeological, cultural, historic, natural, recreational, and scenic qualities.

There are also State of Utah-designated Byways and Backways found within the Planning Area. For a description of these see the recreation section of this document.

3.14.2 Resource Overview

National Historic Trails

The Old Spanish National Historic Trail (OSNHT) is the only National Historic Trail located within the Planning Area. The congressionally designated trail is the estimated location of the trail. Agencies are responsible for collecting data to determine actual alignment. Archaeological inventory has also identified visible portions of the route, that although close in proximity to the designated trail, are a distinct entity. These findings will be treated as contributing portions of the OSNHT subjected to the National Historic Trails System Act and the National Historic Preservation Act. Approximately 43.2 miles of the congressionally designated OSNHT are located within the Planning Area. Of these 43.2 miles, 28.8 miles are located on public land.

The Comprehensive Administrative Strategy for the OSNHT has not been completed and the identification of high potential sites and segments has not been finalized. The Draft Comprehensive Administrative Strategy (2015) has preliminarily identified 13.7 miles of three high potential segments and three high potential sites on public lands in the Planning Area. A high potential segment is one which would afford a high-quality recreation experience in a portion of the route having greater than average scenic values or affording an opportunity to vicariously share the experience of the original users of a historic route. A high potential site is one which provides an opportunity to interpret the historical significance of the trail during the period of its major use.

The OSNHT within the Planning Area can be divided into two parts: 1) the northern part parallels U.S. Highway 191 north of the Colorado River and then generally follows the Blue Hills road toward the town of Green River; and 2) a southern part that follows US Highway 191 south of the Colorado River and forms the eastern boundary of the Planning Area.

Two high potential segments are located in the northern part of the Planning Area: 1) Blue Hills (12.2 miles), and 2) Moab Trail (1.4 miles). One high potential segment, Mule Shoe Wash (0.1 miles), is located in the southern part of the Planning Area. Two high potential sites are located in the southern part of the Planning Area: 1) Looking Glass Rock, and 2) Kane Springs. One other high potential site, the Colorado River Crossing near Moab, spans both the southern and northern parts of the Planning Area.

The Blue Hills high potential segment parallels a high voltage transmission line serving Moab and generally follows a well maintained Class B road. The scenery to the south of the Blue Hills segment is generally undeveloped, although it is crossed by four Class B roads. However, the southern side of the Blue Hills segment could afford an opportunity to share the experience of the historic route. To the north of this segment, the view is highly impacted by a high voltage transmission line located parallel and immediately adjacent to this segment. In addition, a designated utility corridor linking Green River and Moab overlays this entire segment with the majority of the utility corridor lying to the north of the trail. Due to the visual impairments to the north of the trail, very little opportunity is available to vicariously share the experience of the original users of the historic route.

On public lands, only one instance of trail trace (2.46 miles) is visible and is classified as resource condition Category II (location verified and evident with minor alteration) by an inventory conducted in 2009 that included historic trail resources, values, qualities, and associated settings. The visible trace is located within the Blue Hills high potential segment and is intact from the period of significance. No unaltered trail traces (resource condition Category I) have been identified within the Planning Area. In most places, evidence of the trail has been obscured by bladed and paved roads.

National Scenic Byway

The Dinosaur Diamond National Scenic Byway is the only National Scenic Byway located within the Planning Area. The Dinosaur Diamond Scenic Byway is a 512-mile National Scenic Byway located in eastern Utah and western Colorado. The section of the Byway found within the Planning Area includes portions of U.S. 128 and U.S. 191 (Map 3-21). Notable features surrounding the byway include Canyonlands National Park and Arches National Park.

3.15 SPECIAL DESIGNATIONS: WILD AND SCENIC RIVERS

3.15.1 Resource Overview

The Wild and Scenic River Act of 1968 (WSRA) established legislation for a National Wild and Scenic River System (NWSRS) to protect and preserve designated rivers in their free-flowing condition throughout the nation and to protect and preserve their immediate environments. The WSRA includes policy for managing designated rivers and created processes for designating additional rivers to the NWSRS.

A Wild and Scenic River (WSR) review was conducted as part of both the Moab and Monticello 2008 RMP planning process. The first phase of the WSR review involved the inventorying of all potentially eligible rivers to determine which of those rivers were eligible for consideration as part of the NWSRS. To be eligible, rivers must be free-flowing and possess at least one outstandingly remarkable value (ORV). ORVs are evaluated in the context of regional and/or national significance and must be river-related. Each river/segment determined to be eligible is then given a tentative classification based on the current level of human development associated with that river/segment. The tentative classification is based on the criteria listed in the classification table from WSR Review in the State of Utah (BLM 1996) as noted below.

- A Wild river is free of impoundments, with shorelines or watersheds essentially primitive, and with unpolluted waters.
- A Scenic river may have some development, and may be accessible in places by roads.
- A Recreational river is accessible by road (or railroad), may have more extensive development along its shoreline, and may have undergone some impoundment or diversion in the past.

The BLM established WSR eligibility determinations and tentative classification for four rivers/segments within the Planning Area. These rivers/segments are summarized along with their ORVs in Table 3-27.

The second phase of the WSR review occurred as all eligible rivers were taken through the land-use planning process of the RMP to determine their "suitability" for designation into the NWSRS. Suitability is discussed in Chapter 4 of the Final EIS for both Moab and Monticello and "suitability" determinations can be found in the record of decision for the RMPs. The BLM found a total of four suitable rivers/segments in the Planning Area.

Suitable rivers/segments located within the Planning Area are found in Table 3-27 and Map 3-52. These rivers/segments are managed under specified guidelines to protect the free-flowing nature of the rivers/segment, and to protect the identified ORVs and tentative classification. The management of these rivers/segments will continue until Congress, or the Secretary of the Interior, makes the determination that the river will be included in the NWSRS.

Table 3-27. Suitable Rivers/Segments in the Planning Area

River/Segment Name	Segment Description and Approximate Length in Free-Flowing BLM River Miles (BLMRM), total River Miles (TRM)	Outstandingly Remarkable Values	Tentative Classification
Colorado River Segment 4	Confluence with the Dolores River to mile 49 near Potash (BLMRM 32.6) (TRM 15.7)	Scenery, recreation, wildlife, fish, cultural, geology, ecological	Recreational

River/Segment Name	Segment Description and Approximate Length in Free-Flowing BLM River Miles (BLMRM), total River Miles (TRM)	Outstandingly Remarkable Values	Tentative Classification
Colorado River Segment 5 (Moab): same as Segment 2 (Monticello)	River Mile 44.5 to Mile 38.5 State land boundary (BLMRM 6.1) (TRM 6.8)	Scenery Recreation, wildlife, fish, cultural, ecological	Scenic
Colorado River Segment 6 (Moab): same as Segment 3 (Monticello)	River Mile 35.7 State land to Mile 34 Canyonlands National Park (BLMRM 3.8) (TRM 3.8)	Scenery, recreation, wildlife, fish, cultural, ecological	Scenic
Green River Segment 4(a)	Mile 97 to Canyonlands NP boundary (BLMRM 97) (TRM 07)	Scenery, recreation, wildlife, fish, cultural, ecological	Scenic

3.16 SPECIAL STATUS SPECIES

3.16.1 Introduction

The BLM is responsible for managing habitat for special status plant and animal species as well as managing special status plants. Special status species considered in this analysis are those listed as threatened or endangered under the Endangered Species Act (ESA), those proposed for listing or are candidates for listing under the provisions of the ESA, or those designated by the BLM State Director or the State of Utah as sensitive.

The objectives for managing special status species are 1) to conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for these species; and 2) to initiate proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA.

3.16.2 Resource Overview

Special status species occur in a variety of native plant communities across the Planning Area. For BLM management purposes, special status species include species listed as endangered, threatened, proposed, and/or candidate under the ESA, as well as those species listed as sensitive in the State of Utah by the BLM.

Species listed as threatened or endangered are afforded protection under the ESA (BLM Manual 6840). The BLM is required to consult with the U.S. Fish and Wildlife Service (USFWS) on potential impacts to Federally listed species. The USFWS does not consult on candidate species, although they are included for informational purposes in consultation documents and USFWS may provide information and suggestions regarding them during consultation. Periodic review of the special status species list allows for additions and/or removals depending on the status of populations, habitats, and potential threats. During the scoping period the BLM consulted with the Nature Conservancy regarding current special status species data. A total of nine Federally listed species were identified as having the potential to occur within Grand and San Juan Counties. These include four wildlife, one plant, and four fish species.

Sensitive species are managed to prevent further listing, with the same level of protection as candidate species (BLM Manual 6840). BLM sensitive species are designated by the State Director under 16 U.S.C. 1536 (a) (2). The BLM has identified 82 species (that are BLM Sensitive Species, State Sensitive Species, or Wildlife Species of Concern) as having the potential to occur within Grand and San Juan Counties.

Conservation Agreement Species

Conservation Agreements exist among resource agencies in Arizona, Colorado, New Mexico, Utah, and Wyoming to expedite the implementation of conservation measures concerning the following species: Colorado cutthroat trout, the blueheaded sucker, the roundtail chub, the flannelmouth sucker and the northern goshawk. Those species with no known habitat or potential habitat within the Planning Area will not be carried forward in this document.

Threatened, Endangered, and Candidate Species

The USFWS has identified the following threatened, endangered, and candidate wildlife, fish, and plant species located within the Planning Area (Table 3-28). Discussions of each species follow.

Table 3-28. U.S. Fish and Wildlife Service Threatened, Endangered, and Candidate Species within the Planning Area

Common Name (*Scientific Name*)	Habitat	Status	Designated Critical Habitat (BLM Acres)	Potential Habitat (BLM Acres)
Wildlife				
California Condor (*Gymnogyps californianus*)	Roosts and nests in cliff habitat. Forages in open areas.	Endangered, Experimental	None	NA[1]
Mexican spotted owl (*Strix occidentalis lucida*)	Steep rocky canyons.	Threatened	175,304	307,333
Southwestern willow flycatcher *(Empidonax traillii extimus)*	Low scrub, thickets, or groves of small trees, often near watercourses.	Endangered	None	15,202
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Riparian habitats.	Threatened	None	15,202
Fish				
Bonytail (*Gila elegans*)	Eddies, pools, and backwaters near swift current in large rivers	Endangered	19,198	19,198
Colorado pikeminnow (*Ptychochelius lucius*)	Adults can be found in habitats ranging from deep turbid rapids to flooded lowlands. Young prefer slow-moving backwaters	Endangered	19,198	19,198
Humpback chub (*Gila cypha*)	Fast, deep, white-water areas	Endangered	19,198	19,198
Razorback sucker (*Xyrauchen texanus*)	Slow backwater habitats and impoundments	Endangered	19,198	19,198
Plants				
Jones cycladenia *(cycladenia humilis* var. *jonesii)*	Gypsiferous or saline soils on the Chinle, Cutler, and Summerville Formations. Barren slopes of the Moenkopi Formation	Threatened	None	NA[1]

[1.] Incomplete data, acreages not available. They could occur in the area.

Source: USFWS Federally Listed and Proposed Endangered, Threatened and Candidate Species and Critical Habitat in Utah – Species list by County 2012.

California Condor (*Gymnogyps californianus*)

The California condor is a Federally listed endangered species with non-essential, experimental status in Utah south of Interstate 70 and west of U.S. 191. Under Section 10(j) of the ESA (ESA; 16 U.S.C. 1536[c]), this means that the species is treated as though it is proposed for Federal listing, rather than as endangered. No California condors are known to nest in the Planning Area; however, they have the potential to move through the area where suitable nesting habitat does exist. A few condors have been sighted throughout Utah since being released in northern Arizona in 1996 (USFWS 1996a). Any California condors that leave the experimental population area will be considered endangered. The agreement (Endangered and Threatened Wildlife and Plants: Establishment of a Nonessential Experimental Population of California Condors in Northern Arizona) includes provisions for the capture and return of California condors to the experimental population area should they be found outside of it (USFWS 1996b). California condors prefer mountainous country at low and moderate elevations, especially rocky and brushy areas near cliffs. California condor colonies often roost in snags, tall open-branched trees, or cliffs, often near important foraging grounds (Utah Division of Wildlife Resources [UDWR] 2007a). This species lays a single egg between late January and early April. The California condor feeds only on the carcasses of dead animals and it prefers to do so in relatively open areas (USFWS 1996b).

Mexican Spotted Owl (*Strix occidentalis lucida*)

Steep slopes and canyons with rocky cliffs characterize much of the Mexican spotted owl (MSO) habitat in Utah. Within the Colorado Plateau, MSO are known to nest in steep-walled canyon complexes and rocky canyon habitat within desert scrub vegetation. The MSO exists in small isolated subpopulations and is threatened by habitat loss and disturbance from recreation, improper grazing practices, road development, catastrophic fire, timber harvest, and mineral development. The Planning Area contains 175,304 acres of designated critical habitat according to the Spotskey-Willey MSO habitat model (Willey and Spotskey 1997) and roughly 307,333 acres of potential habitat (Table 3-28 and Map 3-53). Within the Planning Area, known nesting territory has been identified. No known nesting territories have been identified within designated critical habitat in the Planning Area. Nesting and breeding begins in March, and eggs are laid in late March or early April and incubated for approximately 30 days. The eggs usually hatch in early May. Nesting MSO fledge from early to mid-June and disperse out of the natal area in the fall.

Southwestern Willow Flycatcher *(Empidonax traillii extimus)*

The Southwestern Willow Flycatcher utilizes and breeds in patchy to dense riparian habitats along streams and wetlands near or adjacent to surface water or saturated soils. These dense patches are often interspersed with small openings, open water, and/or shorter/sparser vegetation, creating a mosaic habitat pattern. Historically, nests were constructed in native willow species, but currently the Southwestern willow flycatcher will utilize both native and exotic species, such as tamarisk and Russian olive that provide desired habitat requirements (Sogge et al. 1997). Nesting season typically begins in May when males arrive to establish breeding territories. The females arrive a week or two later and nest building begins. Eggs are laid and incubated from late May through July. Chicks fledge 12 to 15 days after hatching during July and August and migrate south in late August through early fall. Population declines are attributed to numerous, complex, and interrelated factors such as habitat loss and modification, invasion of exotic plants into breeding habitat, brood parasitism by cowbirds, vulnerability of small population numbers, and winter and migration stress. Southwestern willow flycatcher has been documented migrating along the Indian Creek corridor area. There is a total of 12,155 acres of potential habitat within the Planning Area (Table 3-28 and Map 3-54).

Yellow-Billed Cuckoo (Western) (*Coccyzus americanus occidentalis*)

The Yellow-billed Cuckoo has been listed due to loss of riparian habitat from agricultural use, water use, road development and urban development. No known population of this species exists at present within

the Planning Area. The yellow-billed cuckoo, however, is a neotropical migrant that utilizes riparian valleys throughout the State. The Planning Area contains 15,202 acres of potential riparian habitat for this species (Map 3-54).

Bonytail Chub (*Gila elegans*)

The bonytail chub has drastically declined in numbers since the 1960s and little is known about its biological requirements. Historically it was once widespread throughout the Colorado River Basin. Today it is thought to be found in large river reaches of the Colorado and Green Rivers. The Planning Area contains both possible populations and designated critical habitat for this species. There are 19,198 acres of designated critical habitat within the Planning Area (Table 3-28 and Map 3-55) (USFWS 1990a).

Colorado Pikeminnow (*Ptychochelius lucius*)

Natural populations of the Colorado pikeminnow are restricted to the upper Colorado River Basin in Wyoming, Colorado, Utah, and New Mexico. The main stem of the Colorado River from Palisade, Colorado, to Lake Powell has known population within this region (UDWR 2005a). Flow regulations, migration barriers, habitat loss/alteration, and introduced non-native fish have all been identified as causes of population decline (UDWR 2005a). The Planning Area contains both populations and 19,198 acres of designated critical habitat within the Planning Area (Table 3-28 and Map 3-55) (USFWS 1991).

Humpback Chub (*Gila cypha*)

Populations of humpback chub have been identified in the Upper Colorado River Basin with the highest concentrations found in the Black Rocks and Westwater Canyon reaches of the Colorado River near the Colorado/Utah State line (UDWR 2005a). The presences of juvenile population suggest spawning may occur in the Upper Colorado River at Black Rocks, Westwater Canyon, Cataract Canyon, and Desolation/Gray Canyon (UDWR 2005a). Flow alterations have been identified as a significant cause of decline. The Planning Area contains both populations and 19,198 acres of designated critical habitat within the Planning Area (Table 3-28 and Map 3-55) (USFWS 1990b).

Razorback Sucker (*Xyrauchen texanus*)

The Green River has the only known spawning areas for the razorback sucker, some of which are found in the Planning Area. Populations have been identified in the Colorado River from Rifle Colorado to Lee's Ferry Arizona and also in areas of the Green, Gunnison, and Yampa Rivers (UDWR 2005a). The Planning Area contains both populations and USFWS designated Critical Habitat for this species. There are 23,327 acres of designated critical habitat within the Planning Area (Table 3-28 and Map 3-55) (USFWS 1999).

Jones cycladenia (*Cycladenia humilis* var. *jonesii*)

Jones cycladenia is endemic to Utah and Arizona. It occurs in barren substrates below the sandstone cap of mesas at elevations ranging from 4,298 to 6,749 feet. Blooming takes place from mid-May through June. Surveys completed in 2014 found at least one population of Jones cycladenia in the Planning Area covering approximately one acre on public lands on the slopes below Dead Horse Point State Park.

BLM Sensitive Species

The BLM maintains a list of sensitive species that may occur on managed lands. The BLM Utah State director's Sensitive Species List includes those that are Federally listed species (those not listed in Table 3-28), those identified by the BLM, and those listed as State sensitive by the State of Utah. Table 3-29 identifies the sensitive species that are known, or have that potential to occur within the Planning Area. A brief description for sensitive wildlife and plant species follows this table.

Table 3-29. Sensitive Species within the Planning Area

Common Name (*Scientific Name*)	Habitat Description	Potential Habitat (BLM Acres)
Wildlife		
Bald eagle (*Haliaeetus leucocephalus*)	Roosts and nests in tall trees near bodies of water.	133,581
Big free-tailed bat (*Nyctinomops macrotis*)	Rocky and woodland habitats, roosts in caves, mines, old buildings, and rock crevices.	Unknown
Bobolink (*Dolichonyx oryzivorus*)	Riparian or wetland areas	Unknown
Burrowing owl (*Athene cunicularia*)	Open grassland and prairies	362,285
Ferruginous hawk (*Buteo regalis)*	Flat and rolling terrain in grassland or shrub steppe; nests on elevated cliffs, buttes, or creek banks	33,395
Fringed myotis (*Myotis thysanodes*)	Desert and woodland areas, roosts in caves, mines, and buildings.	Unknown
White-tailed prairie dog *(Cynomys leucurus)*	Grasslands, semidesert and montane shrublands	Unknown
Gunnison's prairie dog (*Cynomys gunnisoni)*	Grasslands, semidesert and montane shrublands	6,825
Kit fox *(Vulpes macrotix)*	Semi desert grasslands and open shrublands	783,381
Long-billed curlew (*Numenius americanus*)	Grassland/ herbaceous	Unknown
Mogollon vole (*Microtus mogollonensis*)	Dry meadows	Unknown
Peregrine falcon (*Falco peregrinus*)	Steep, rocky canyons near riparian or wetland areas	Unknown
Short-eared owl (*Asio flammeus)*	Grasslands, shrublands, and other open habitats	Unknown
Spotted bat (*Euderma maculatum*)	Found in a variety of habitats, ranging from deserts to forested mountains; roost and hibernate in caves and rock crevices.	Unknown
Townsend's big-eared bat (*Corynorhinus townsendii*)	Occurs in many types of habitat, but is often found near forested areas; roosts and hibernates in caves, mines, and buildings.	Unknown
Western red bat (*Lasiurus blossevillii*)	Forest - Hardwood, Forest - Mixed, Suburban/orchard, Woodland - Hardwood, Woodland – Mixed, riparian	Unknown
Fish		
Flannelmouth sucker (*Catostomus latipinnis*)	Large rivers, where they are often found in deep pools of slow-flowing, low gradient reaches	Unknown
Roundtail chub (*Gila robusta)*	Large rivers, and is most often found in murky pools near strong currents	Unknown
Amphibians and Reptiles		

Common Name (*Scientific Name*)	Habitat Description	Potential Habitat (BLM Acres)
Cornsnake (*Elaphe guttata*)	Near streams, or in rocky or forest habitats	Unknown
Great Plains toad (*Bufo cognatus*)	Cropland/hedgerow, Desert, Grassland/herbaceous, Shrubland/chaparral, Suburban/orchard	Unknown
Plants (see Map 3-56 for Habitat for the Following BLM Sensitive Plants)		
Alcove rock daisy (*Perityle specuicola*)	Drier crevices in seasonally wet hanging gardens, and alcove communities. Navajo and Wingate sandstone and Rico Formation, but not substrate specific. Blooms mid-July-late Sept. 3,690-4,000 feet.	Unknown
Canyonlands lomatium (Canyonlands biscuitroot, or Canyonlands desert-parsley) (*Lomatium latilobum*)	Sandy soil or crevices in Entrada sandstone. Slot canyons. (Found in Navajo sandstone that weathers like Entrada in Sand Flat and Mill Creek.) Prefers the sheltered, cool habitat on all slopes and aspects. April-June. 4,800-6,855 feet.	Unknown
Cisco milkvetch (*Astragalus sabulosus var. sabulosus*)	Salt desert shrub in Mancos Shale Formation in Grand River Valley (Cisco desert). Selenophyte. Blooms late March-May. 4,260-5,250 feet.	Unknown
Entrada rushpink (or skeletonweed) (*Lygodesmia grandiflora* var. *entrada*)	Juniper, mixed desert shrub communities. June. 4,400-4,800 feet.	Unknown
Jane's globemallow (*Sphaeralcea janeae or S. leptophylla var. janeae*)	Sandy soils of weathered white rim and Organ Rock members of Cutler Formation. Warm and salt desert shrub. 4,000-4,600 feet. Blooms May-June.	Unknown
Paradox breadroot (*Pediomelum aromaticum var. tuhyi*)	Pinyon-juniper woodland and mixed desert shrub on Entrada, Kayenta and Mossback Formations. 5,600- 6,500 feet. Blooms May- June.	Unknown
Stage-station milkvetch (*Astragalus sabulous* var. *vehiculus*)	Salt desert shrub in Morrison Formation. Selenophyte. Blooms April-May. 4500 to 4,800 feet. Considered geographically isolated from var. *sabulous.*	Unknown
Trotter's oreoxis (spring-parsley) (*Oreoxis trotter)*	Mixed juniper and warm desert shrub. Slickrock or Main Body Entrada sandstone on eastern slope of Courthouse Rock and Navajo sandstone below on flats. Most abundant on Moab Tongue white sandstone of Entrada. Late April mid- June. 4,750-5,000 feet.	Unknown

Sources: USFWS 2012; BLM 2002b; Atwood et al. 1991; Welsh et al. 2003; Utah Native Plant Society 2005; BLM 2008a and 2008b.

Bald Eagle (*Haliaeetus leucocephalus*)

Utah's wintering bald eagle population is typically found near rivers, lakes, and marshes where unfrozen, open waters offer the opportunity to prey on fish and waterfowl. The Colorado and Green River corridors are used frequently by Utah's wintering bald eagles. The eagles begin to arrive in November and head north by March. Utah also hosts a small population of desert bald eagles that can be found in desert valleys, far from any water. These eagles feed primarily on carrion. There are four active nests which occur on the

Colorado River but are not within the Planning Area. Nesting bald eagles in the Planning Area return to their nesting territories in early spring. Egg laying and incubation occurs from February through May with eaglets hatching during May and early June, and fledging by early July. The bald eagle continues to be protected by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act. Within the Planning Area there are approximately 133,581 acres of potential bald eagle habitat (Map 3-57).

Big Free-tailed Bat (*Nyctinomops macrotis*)

The big free-tailed bat is listed as a BLM Sensitive Species because of declining population sizes and limited distribution within the State. It is a migratory species and is known from the southern half of Utah, although it may range farther north. The big free-tailed bat has been captured in riparian, desert shrub and montane forest habitat types (UDWR 2005a). The Planning Area does contain potential habitat, but the exact acreages are unknown.

Bobolink (*Dolichonyx oryzivorus*)

The bobolink is listed as a BLM Sensitive Species and a State Sensitive Species because of range-wide declining populations and limited habitat. Wet meadow habitats which are the preferred bobolink habitat have been decreased and fragmented in Utah due to many of the same factors that impact riparian areas, e.g., agricultural encroachment, urban encroachment, road development, water development (reservoirs and in-stream flow depletions), and channelization (Parrish et al. 2002). The Planning Area does contain potential winter habitat, but the exact acreages are unknown and minimal.

Burrowing Owl (*Athene cunicularia*)

The burrowing owl is listed as a BLM Sensitive Species to recent decreases in population size. Burrowing owls are neotropical migrants, nest underground in burrows, and are typically found in open desert grassland and shrubland areas that are level and well drained (Gleason and Johnson 1985). They depend on burrowing mammals for nest sites and are often associated with prairie dog colonies (Konrad and Gilmer 1984). The decline of the owl's population across its range appears to be due primarily to agricultural practices, use of pesticides, and the decline of prairie dog colonies (Haug et al. 1993). The Planning Area contains approximately 362,285 acres of burrowing owl potential habitat (Map 3-58).

Ferruginous Hawk (*Buteo regalis)*

The ferruginous hawk, a BLM Sensitive Species, is the largest of the North American buteos. It is a neotropical migrant breeding from southwestern Canada to central Arizona, New Mexico, and northern Texas and wintering in California to northern Mexico. It is a year-round resident from Nevada through western and southern Utah, northern Arizona, and New Mexico to eastern Colorado and South Dakota. In Utah, the ferruginous hawk nests at the edge of juniper habitats and open, desert and grassland habitats in the western, northeastern, and southeastern portions of the State. Within the Planning Area they are found through the Cisco Desert, and along the Colorado and the Green Rivers. Ferruginous hawks are highly sensitive to human disturbance and are also threatened by habitat loss from surface disturbance, agricultural practices, and urban encroachment. They have experienced decline across much of their range and have been extirpated from some of their former breeding grounds in Utah (UDWR 2005a). The Planning Area contains approximately 33,395 acres of ferruginous hawk potential habitat (Map 3-59).

Fringed Myotis Bat (*Myotis thysanodes*)

The fringed myotis bat is listed as BLM Sensitive Species because of limited distribution within the State. This species occurs predominantly in southern Utah, although records of this species occur throughout the State. Fringed myotis occur in a variety of habitat including riparian, desert shrub, pinyon-juniper woodland, mountain meadow, ponderosa pine, and montane forest (UDWR 2005a). The Planning Area does contain potential habitat, but the exact acreages are unknown.

Gunnison's Prairie Dog (*Cynomys gunnisoni)*

The Gunnison's prairie dog is listed as a BLM Sensitive Species. This species is highly susceptible to sylvatic plague and has a low ability to repopulate once the plague has decimated a colony. Mortality from plague frequently exceeds over 99 percent within colonies. Additional threats include poisoning, agricultural conversion, and urbanization and development (UDWR 2005a). The Planning Area contains approximately 6,943 acres of Gunnison prairie dog potential habitat (Map 3-60) according to a draft model developed by UDWR.

Kit Fox (*Vulpes macrotix*)

The kit fox is listed as a BLM Sensitive Species. It opportunistically eats small mammals (primarily rabbits and hares), small birds, invertebrates, and plant matter. The species is primarily nocturnal, but individuals may be found outside of their dens during the day. The kit fox mates in late winter, with a litter of four to seven pups being born about two months later. Young first leave the den about one month after birth, in late spring or early summer. The species most often occurs in open prairie, plains, and desert habitats. The Planning Area contains approximately 783,381 acres of kit fox potential habitat.

Long-billed Curlew (*Numenius americanus*)

The long-billed curlew breeds from south-central British Columbia, southern Alberta, southern Saskatchewan, and southern Manitoba south to east-central California, central Nevada, central Utah, central New Mexico, and northern Texas, and east to southwestern North Dakota, northwestern South Dakota, north-central Nebraska, and southwestern Kansas. It winters from Washington, extreme northern Mexico, southern Texas, southern Louisiana, southern Alabama, and coastal South Carolina south to southern Mexico (Oaxaca, Veracruz, and the Yucatan Peninsula) and southern Florida, irregularly through northern Central America to Honduras and Costa Rica (American Ornithological Union 1998). The long-billed curlew is a fairly common summer resident and migrant in Utah, especially through the central and more northern valleys. It is less common in the Colorado River drainage. This species lives and breeds in higher and drier meadowlands than many other shorebird species (Parrish et al. 1999). The Planning Area does contain potential habitat, but the exact acreages are unknown.

Peregrine Falcon (*Falco peregrinus*)

Although the peregrine falcon is still rare in Utah, it has become much more abundant throughout its range in recent years. The widespread use of the pesticide DDT in the 1940s, 1950s, and 1960s caused a drastic reduction in peregrine falcon numbers (and in the numbers of other raptor species) throughout North America. It was eventually determined that DDT was moving up the food chain and causing raptors to lay thin-shelled eggs that would often break during incubation. DDT was banned in the early 1970s, which allowed the peregrine falcon to start its recovery. By August 1999, the peregrine falcon had recovered to the point that it was removed from the Federal endangered species list (UDWR 2005a). The Planning Area does contain potential habitat, but the exact acreages are unknown. The Utah Natural Heritage Database has approximately 50 nests identified within the Planning Area though current activity is not known on many of them.

Short-Eared Owl (*Asio flammeus)*

The short-eared owl is listed as a BLM Sensitive Species. This owl is usually found in grasslands, shrublands, and other open habitats. There is some concern that short-eared owl populations are declining. The Planning Area contains potential habitat, but the exact acreages are unknown.

Spotted Bat (*Euderma maculatum*)

The spotted bat is listed as a BLM Sensitive Species and is considered rare in Utah (although the spotted bat's distribution ranges throughout the western states from British Columbia to Mexico). The spotted bat

has a very low reproductive potential, and therefore once populations are reduced they rebuild slowly. Several sightings were reported to the UDWR in the southern portion of the Planning Area in 1959 and 1965, although no current populations are known today (UDWR 2005a). The Planning Area does contain potential habitat, but the exact acreages are unknown.

Townsend's Big-Eared Bat (*Corynorhinus townsendii*)

The Townsend's big-eared bat is a BLM Sensitive Species, and USFS-listed Sensitive species due to limited distribution and a declining population (Oliver 2000). The Townsend's big-eared bat is a cave-roosting species that moves into man-made caves such as mines and buildings. Unlike many other bats, they are unable to crawl into crevices and usually roost in enclosed areas where they are vulnerable to disturbance. The Townsend's big-eared bat is quite sensitive to human disturbance, and this appears to be the primary cause of population decline for this species. This bat is colonial during the maternity season, when compact clusters of up to 200 individuals might be found. Maternity roosts form in the spring and remain intact during the summer. Site fidelity is high, and if undisturbed, the bats will use the same roost for many generations (Brown 1996). The Planning Area does contain potential habitat, but the exact acreages are unknown and there is no known habitat within the Planning Area.

Western Red Bat (*Lasiurus blossevillii*)

The western red bat occurs in the western U.S. and parts of Mexico. The species is extremely rare in Utah, being known from only a few locations in the State. It is included on the Utah Sensitive Species List.

Western red bats are normally found near water, often in wooded areas. Some individuals may hibernate during cold times of year, but most members of the species migrate south to warmer climates for the winter. The species is nocturnal; daytime roosting usually occurs in trees. Females may give birth to one litter of two to four young during late spring. Western red bats eat insects, often foraging near riparian areas (UDWR 2005b, Burt 1980). The Planning Area does contain potential habitat.

Flannelmouth Sucker (*Catostomus latipinnis*)

The flannelmouth sucker is listed as a BLM Sensitive Species, as it now occupies only 50 percent of its historical range within the Upper Colorado River Basin. Within the Planning Area, populations are known to occur in the Colorado, Green and Dolores Rivers. Populations have declined since the 1960s due to impoundment of the mainstem of the Green and Colorado Rivers. (Flannelmouths have been extirpated from portions of the Gunnison River.) This fish is also susceptible to altered thermal and hydrological regimes, hybridization and competition of non-native fish (UDWR 2005b). The Planning Area does contain potential habitat.

Roundtail Chub (*Gila robusta)*

The roundtail chub is listed as a BLM Sensitive Species as it has been extirpated from 45 percent of its historical distribution in the Colorado River Basin. Within the Planning Area, populations are known to occur in the Colorado River from the Utah border to Moab and in the Green River from the Colorado-Green confluence upstream to Echo Park. Declines in populations are attributed to hybridization with other chub, habitat loss and degradation due to dam and reservoir construction, competition and predation of non-natives, parasitism, and dewatering activities (UDWR 2005b). The Planning Area does contain potential habitat.

Cornsnake (*Elaphe guttata*)

The cornsnake is listed as a BLM Sensitive Species because of limited distribution and its potential for genetic uniqueness from the cornsnakes east of the Continental Divide. The cornsnake is associated with the Colorado and Green River corridors and population declines are attributed to habitat degradation,

vegetative changes, and illegal collection (UDWR 2005b). The Planning Area does contain potential habitat, but the exact acreages are unknown.

Great Plains Toad (*Bufo cognatus*)

The Great Plains toad is a common and widespread toad that occurs across the central U.S., much of Mexico, and limited areas of Canada. In Utah, the Great Plains toad occurs in scattered areas throughout the State, where it prefers desert, grassland, and agricultural habitats. In cold winter months, the Great Plains toad burrows underground and becomes inactive (UDWR 2005b, Stebbins 1985). The Planning Area does contain potential habitat, but the exact acreages are unknown and there is no known habitat within the Planning Area.

Alcove Rock Daisy (*Perityle specuicola*)

This plant is endemic to Grand and San Juan Counties, Utah. It grows in hanging garden communities in narrow protected canyons at 3,690 to 4,000 feet in elevation, and flowers from mid-July to late September. It is associated with Navajo Sandstone and Cedar Mesa sandstone.

Canyonlands Lomatium (*Lomatium latilobum*)

This plant grows mainly on the Entrada Sandstone Formation between 4,800 to 6,855 feet in elevation. It is endemic to the Canyonlands area.

Cisco Milkvetch (*Astragalus sabulosus* var. *sabulosus*)

This plant is endemic to the Grand River Valley in Grand County, Utah. It grows in desert shrub communities at 4,260 – 5,250 feet in elevation and flowers in April. By mid-May the plants bear large sausage-like decline fruit. It is a primary selenium indicator; its flowers are the largest within the Astragalus family.

Entrada Rushpink (*Lygodesmia grandiflora* var. *entrada*)

This plant is endemic to Emery and Grand Counties, Utah. It is found in the Tusher Canyon area northwest of Moab. The plant is closely related to others in its genus, but differs in its unusually white flowers, larger growth and more ligneous stems.

Jane's Globemallow (*Sphaeralcea janeae* or *S. leptophylla* var. *janeae*)

This plant grows in the Navajo Sandstone formation, in crevices of canyon walls in loosely cemented sandstone. This subspecies is taller and of a different color to the rest of the plants in its species.

Paradox Breadroot (*Pediomelum aromaticum* var. *tuhyi*)

This plant grows in the entrada, Morrison, Kayenta and Mossback formations. It is found in the Hatch Point area.

Stage Station Milkvetch (*Astragalus sabulosus* var. *vehiculus*)

This subvariety of the Cisco milkvetch grows in the vicinity of the historic stage station along the pioneer trail from Moab to Green River.

Trotter's Oreoxsis (*Oreoxsis trotteri*)

This plant is endemic to Emery and Grand Counties, Utah. It is distinct from two other species of oreoxsis, forming clumps of up to 30 centimeters long.

3.17 VEGETATION

3.17.1 Resource Overview

Vegetation is defined as plants considered collectively, especially those found in a particular area or habitat. Vegetation in the Planning Area supports livestock grazing, as well as indirect benefits such as wildlife cover, browse, and nesting habitat for a variety of wildlife species. Vegetation also functions in the hydrologic cycle as a dynamic interface between the soil and atmosphere. It intercepts precipitation, retards overland flow, retains soil water and nutrients (root absorption), and transports water and nutrients back to the atmosphere via stems and leaves (evapotranspiration). Vegetation is also an integral part of what makes the Planning Area an aesthetically pleasing destination for visitors.

The State of Utah is divided into five major eco-regions determined by geographic and climatic similarity. The Planning Area occurs entirely within the Colorado Plateau ecological province. The unique climate and geology of the Colorado Plateau allow for the growth of many endemic and rare plant species and, thus, a substantial amount of biodiversity. The variety of elevations and precipitation zones within the Planning Area only enhances the area's biodiversity.

Dominant Vegetation Communities

Vegetation across the Planning Area has been identified using Southwest Regional Gap Analysis Project (Lowry Jr. et al. 2005). Gap vegetation data were developed using multi-spectral satellite imagery in conjunction with image processing and classification software. The relationship between spectral signatures and a given vegetation type was further refined via development of models that incorporated a variety of topographic and distributional information for that given vegetation type. SWReGAP vegetation data were intended to be used for depicting the distribution of the State's various vegetation types at scales of 1:100,000 or smaller. While adequate for characterizing vegetation over large areas, these data are less accurate when viewed for smaller project areas. Utah Gap Analysis data indicate the following cover types and acreages in the Planning Area (Table 3-30). Similar cover types have been grouped together and are described in the sections following Table 3-30. The cover types that do not have significant native vegetation (Unclassified and Disturbed Areas) are presented in the table, but not discussed in this document.

Table 3-30. Acres of Land by SWReGAP Cover Type in the Planning Area

Cover Type	Monticello Field Office* (BLM Acres)	Moab Field Office* (BLM Acres)	Planning Area (BLM Acres)	Planning Area (Percent)
Unclassified Areas	1,068	1,873	2,941	0.4
Blackbrush	38,623	150,205	188,828	24.1
Disturbed Areas	718	1,285	2,003	0.3
Douglas-fir / Mixed Conifer	17	4	15	0.0
Dunes	409	22,714	23,123	2.9
Grasslands	2,913	22,976	25,889	3.4
Invasives	2,576	8,647	10,223	1.3
Mountain Shrub	194	43	237	0.0
Pinyon-Juniper Woodland	113,056	208,145	321,201	41.0
Ponderosa Pine	12	20	32	0.0

Cover Type	Monticello Field Office* (BLM Acres)	Moab Field Office* (BLM Acres)	Planning Area (BLM Acres)	Planning Area (Percent)
Riparian / Wetlands	1,404	567	1,971	0.3
Sagebrush	28,712	39,560	68,272	8.7
Salt Desert Shrub	14,240	125,585	139,825	17.6
Total Acres	**250,847**	**695,618**	**946,466**	**100%**

*Field Office acres listed are only acres within the Planning Area.

The distribution of vegetation types in the Planning Area is primarily influenced by soil type, elevation, precipitation, and topography, and also by land management activities such as livestock and wildlife grazing, road and minerals development, and OHV use. Additionally, vegetation communities were impacted by severe drought conditions existing in the area from 1998 through 2004. See Map 3-61 for the distribution of vegetation across the Planning Area.

Blackbrush

This vegetation type accounts for approximately 24 percent of the cover in the Planning Area. This ecological system typically occurs on gentle benchlands, colluvial slopes, pediments or bajadas, and steep or rocky slopes of mountains, canyons, and mesas with varying aspects. This system is an evergreen, microphyllous desert scrub with succulents, half-shrubs, and scattered deciduous shrubs typically found at elevations ranging from 1,900-5,250 feet. This shrubland system occurs in an arid to semi-arid climate with annual precipitation in the form of summer monsoons and winter storms averaging approximately eight inches. Soils are highly variable and parent materials may include shale, sandstone, limestone, quartzites, and igneous rocks. Soils are generally coarse-textured, calcareous, non-saline and gravelly, often rocky, shallow and well drained. Substrates are shallow, typically sandy soils over sandstone alluvium or caliche. It also occurs in deeper soils on sandy plains where it may have invaded desert grasslands. Effective soil moisture appears to be primarily controlled by regolith depth and position in relation to the water table. This brushland system occupies most sites where regolith is uniformly shallow. In association with blackbrush (*Coleogyne ramosissima*) sites, the soil moisture is concentrated on top of impermeable bedrock at a shallow depth. This perching effect allows for gradual uptake of moisture by the plants roots (Loope and West 1979). This permits growth of plants with more mesic habitat requirements (Warren et al. 1982). Onsites with deep soil, blackbrush may occur in almost pure occurrences with only a few associated species (Warren et al. 1982). Dark-colored cryptogamic soil crusts composed of lichens, mosses, fungi, and algae, are often present in this system in fairly undisturbed areas. Sandy soils may have more cryptogamic crusts than clayish or silty soil surfaces.

Douglas-fir/Mixed Conifer and Ponderosa Pine

This vegetation type accounts for approximately less than one percent of the cover in the Planning Area. The annual precipitation ranges from 14 to 25 inches in areas that support this vegetation community. Elevations range from 6,000 to 9,000 feet and slopes are often extremely steep. The soils are more fertile than those in other areas. Due to the extreme slopes and often rocky terrain these community types are generally managed for wildlife habitat (Natural Resources Conservation Service [NRCS] 1989). This vegetation community is defined as a conifer forest or woodland with Douglas-fir, ponderosa pine, or quaking aspen dominate, associated, or co-dominate with mountain shrub. The principle tree species are Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*) and quaking aspen (*Populus tremuloides*) and other associated tree species, including subalpine fir (*Abies lasiocarpa*), white fir (*Abies concolor*), Englemann spruce (*Picea engelmannii*), and limber pine (*Pinus flexilis*). Principle shrub species include Gamble oak (*Quercus gambelii*), bitterbrush (*Purshia tridentata*), bigtooth maple (*Acer*

grandidentatum), snowberry (*Symphoricarpos oreophilus* A. Gray), serviceberry (*Amelanchier utahensis)*, manzanita (*Arctostaphylos* spp.*)*, and ninebark (*Physocarpus* spp.). Other associated shrub species include common juniper (*Juniperus communis*), sagebrush (*Artemisia* spp.), rabbitbrush (*Chrysothamnus* spp.), and curlleaf mountain mahogany (*Cercocarpus ledifolius*). Although this vegetation type is not actively managed and only represents less than one percent of the Planning Area, it provides crucial wildlife habitat and ecological diversity. It is comprised of high elevation tundra vegetation; including grasses, forbs, sedges, and shrubs. Principle species include Ross' avens (*Geum rossii*), sedges (*Carex* spp.), tufted hair grass (*Deschampsia caespitosa*), Colorado fescue (*Festuca brachyphylla*), American bistort (*Polygonum bistortoides*), and willow (*Salix* spp.). The primary associated tree species is Engelmann spruce krummholz (*Picea engelmannii*).

Dunes

Dune communities comprise 2.9 percent of the Planning Area. Dunes are found primarily in the canyon lands and high plateaus of the Colorado Plateau. This area has been structurally uplifted over time while the rivers flowing across it were cutting down into its bedrock. This site occurs on dunes, coppice dunes, and mesas (NRCS 2011). The dune lands are characterized by mounds of sand that are four to 20 feet in height and ten to 200 feet in diameter. Dunes support little vegetation if any. The present vegetation in most areas consists of sand sage (*Artemisia filifolia*), Havard oak (*Quercus havardii*), slender buckwheat (*Eriogonum* spp.), Indian ricegrass (*Oryzopis hymenoides*), James galletta (*Pleuraphis jamesii*), sand dropseed (*Sporobolus cryptandrus*), sandhill muhly (*Muhlenbergia pungens*), and a variety of forbs. In the lower lying areas where the water collects it can support Fremont cottonwood (*Populus fremontii*) and greasewood (*Sarcobatus vermiculatus*) (NRCS 1989). Dune communities occur in elevation from 4,100 to 5660 feet with an average precipitation of five to ten inches annually.

Grasslands

Grassland communities occur as a unique component of the Planning Area. They are similar to salt-desert, sagebrush, and blackbrush types in species composition, but differ in that grasses dominate instead of browse species. The dominant grass species depend on the soil, with species such as saltgrass (*Distichlis stricta*), galleta grass (*Pleuraphis jamesii)*, squirreltail (*Hordeum jubatum*), blue grama (*Bouteloua gracilis*), and western wheatgrass occurring on heavy soils. Sandy sites usually support species such as Indian ricegrass (*Oryzopis hymenoides)*, sand dropseed (*Sporobolus cryptandrus*), and needle-and-thread grass. Grassland communities occur from 4,000 to 6,000 feet elevation with an average precipitation total of five to 15 inches (Vallentine 1961).

Pinyon-juniper woodland and shrub encroachment, along with that of invasive annuals such as cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola tragus*), are the main issues of concern for this community type.

Mountain Shrub

This vegetation type accounts for less than one percent of the cover in the Planning Area. Deciduous shrubland principally dominated by alder-leaf mountain-mahogany (*Cercocarpus montanus*), cliff-rose (*Purshia mexicana*), bitterbrush (*Purshia tridentata*), serviceberry (*Amelanchier utahensis* and *Amelanchier alnifolia*), buckbrush (*Ceanothus* spp.), chokecherry (*Prunus virginiana*), snowberry (*Symphoricarpos* spp.), point-leaf manzanita (*Arctostaphylos pungens*) and bearberry (*Arctostaphylos uva-ursi*). Primary associated shrub species include Gambel oak (*Quercus gambelii*), palmer oak (*Quercus chrysolepis*), Tucker's oak (*Quercus welshii*), Turbinella live-oak (*Quercus turbinella*), sagebrush (*Artemisia L.* Sagebrush) and maple (*Acer* spp.) Primary associated tree species include quaking aspen (*Populus tremuloides*) and curl-leaf mountain-mahogany (*Cercocarpus ledifolius*).

Pinyon-Juniper Woodland

This vegetation type accounts for approximately 40 percent of the cover in the Planning Area. These woodland species generally grow at elevations between 4,700 and 8,600 feet where precipitation totals 12 to 18 inches per year. The supporting landscape varies in topography from level to steep slopes (0 percent to 80 percent). Dominant tree species include pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Primary associated shrub species include sagebrush, Mormon tea, and blackbrush. Dominant grass species include saline wildrye. Pinyon dominates the overstory as stands reach the upper limits of the elevational range, whereas juniper dominates at lower elevations. As elevation increases within this zone, stand structure changes from open overstory with a sparsely vegetated understory to more dense with a greater variety of species. Land treatments followed by crested wheatgrass seedings have historically occurred within this community type and are considered altered ecological sites.

Unhealthy pinyon-juniper woodland stands are evident across the Planning Area, especially on sites with shallow soils. Pinyon mortality, attributed to the combination of drought, Ips beetle, and root disease, is estimated at 20 to 30 percent in the Monticello Planning Area. It is reasonable to assume a similar mortality throughout the Planning Area. Pinyon is a valuable resource for other programs such as woodlands (firewood harvest) and wildlife habitat management. It also provides pine nuts for human collection and consumption. The increase in dead wood has led to an increase in fuel loading and area fire hazards. However, this dead wood also provides a short term resource as collectable firewood.

Pinyon-juniper woodland encroachment on sites with deep soils is continuing. More sagebrush communities and understory vegetation are lost as this occurs, resulting in an increase in soil erosion. Following wildfires, rehabilitation seedings have occurred in pinyon-juniper woodlands.

Riparian/Wetlands

This vegetation type accounts for less than one percent of the cover in the Planning Area. Riparian and wetland areas contain vegetation associated with surface or subsurface moisture. Wetlands require prolonged saturation of soils and contain certain vegetative species dependent upon soil saturation. Less than one percent of the Planning Area is riparian; these areas are located along major rivers, drainages, or spring sites. Riparian vegetation in the Planning Area is generally located in areas with an elevation of less than 5,500 feet. Principal woody species include Fremont cottonwood (*Populus fremontii*), salt-cedar (*Tamarix chinensis*), coyote willow (*Salix exigua*), and squawbush (*Rhus aromatica* var. *trilobata*). Principal wetland species include cattail (*Typha latifolia*), bullrush (*Scirpus* spp.), and sedge (*Carex* spp.). More detailed information concerning riparian and wetland species are located in the Riparian section of this document.

Hanging gardens and spring-fed vegetation communities are rare to the arid and semiarid environments of the Colorado Plateau. Hanging gardens occur where groundwater seeps through sandstone or limestone substrates, often along overhanging cliffs adjacent to rivers. Plants found in hanging garden communities are often wetland-riparian species endemic to the Colorado Plateau (Spence unpub.). Spring-supported communities often contain riparian woodlands of species such as willow and cottonwood. Some less common mixed-deciduous woodlands comprised of species such as birchleaf buckthorn (*Rhamnus betulifolia*) are also found in the region.

Sagebrush

This vegetation type accounts for approximately 8.7 percent of the cover in the Planning Area. The landscapes that support this vegetation community have moderately deep soils and precipitation totaling 11 to 16 inches per year. Elevation ranges from 5,500 to 7,300 feet with little localized relief. Big sagebrush (*Artemisia tridentata*) dominates the vegetation in this community type. Elevation and soil depth influence the species composition and density, which may include horsebrush, rabbitbrush, spiny hopsage, saltbush,

Mormon tea, and winterfat (*Krascheninnikovia lanata*) (MacMahon 1988). Principle grass species include sand dropseed (*Sporobolus cryptandrus*), western wheatgrass (*Elymus smith*ii), Indian ricegrass, and galleta. Land treatments, including crested wheatgrass (*Agropyron cristatum*) seedings, have historically occurred within this community type and are considered altered ecological sites. Additionally, significant percentages of sagebrush have also been converted to monotypic stands of exotic cheatgrass (*Bromus tectorum*) or Russian thistle (*Salsola kali*) as a result of wildfires, drought, and improper grazing management practices. Appropriate revegetation methods can be effective in restoring diverse community compositions in this zone, but large-scale rehabilitation has yet to be implemented successfully within the Planning Area (personal communication between Daryl Trotter, BLM, and Susan Kammerdiener, SWCA Environmental Consultants on January 6, 2006).

Salt Desert Shrub

This vegetation type accounts for approximately 17.6 percent of the cover in the Planning Area. Areas supporting salt desert shrub vegetation receive relatively low annual precipitation (5 to 10 inches), which results in very little soil moisture available for plant growth. Elevations range is from 4,000 to 5,400 feet. Soils are often very saline or alkaline and vary in moisture availability, from drier, well-drained areas to areas where the water table is near the surface (MacMahon 1988). Dominant shrub species include shadscale (*Atriplex confertifolia*), greasewood (*Sarcobatus vermiculatus*), blackbrush (*Coleogyne ramosissima*), four-wing saltbush (*Atriplex canescens*), Nuttall's saltbush (*Atriplex nuttallii*), mat saltbush (*Atriplex corrugata*), Mormon tea (*Ephedra* spp.), spiny hopsage (*Grayia spinosa*), horsebrush (*Tetradymia canescens*), and rabbitbrush *Chrysothamnus* spp.). Dominant forb species include snakeweed (*Gutierrezia sarothrae*) and buckwheat (*Eriogonum* spp.). Dominant grass species include saline wildrye (*Leymus salinus*), galleta (*Hilaria jamesii*), Indian ricegrass (*Stipa hymenoides*), and sand dropseed (*Sporobolus airoides*). These communities are generally associated with Mancos-derived clay soils, which are extremely susceptible to wind and water erosion following surface disturbances. For additional information see the Soils section of this document.

Special Status Plant Species

Special status plant species include all Federally listed threatened and endangered species and BLM sensitive species. Special status plant species with potential to occur in the Planning Area are listed and discussed in the Special Status Species section of this document.

Invasive Species and Noxious Weeds

One of the BLM's highest priorities is to promote ecosystem health and one of the greatest obstacles to achieving this goal is the rapid expansion of invasive, non-native species or weeds across public lands. A noxious weed is any plant designated by a Federal, State, or County government as injurious to public health, agriculture, recreation, wildlife, or property (Sheley, Petroff, and Borman 1999). Noxious weeds are designated and regulated by various State and Federal laws. A systematic weed inventory has not been completed for the Planning Area. The BLM treats weed infestations, including those within the Planning Area, with mechanical, cultural, chemical, manual, biological, and prevention measures. Noxious weeds are non-native species (BLM 1991b). They are capable of invading plant communities and replacing native species, and are particularly successful following a disturbance. If not eradicated or controlled, noxious and invasive weeds could jeopardize the health of the public lands and the myriad of activities that occur on them. Noxious and invasive weed species identified in Grand County and San Juan County are listed in Table 3-31.

The spread of invasive species across the management area continues to be a primary concern. Tamarisk and Russian olive infestations are found in many waterways and have resulted in vegetation compositions far removed from native riparian plant communities. Although known as a highly invasive species, without

official designation as a problematic species, tamarisk eradication has not been mandatory in Utah. Populations of Russian knapweed have also reached high levels in many river corridors with camelthorn and ravennagrass (*Saccharum ravennae*) following suit. New species invasions such as these threaten existing vegetation communities, species diversity, and habitats of special status species.

Effects of the current drought are evidenced by reduced plant productivity. Unfavorable climactic conditions also predispose vegetation to insect infestations. Visitor numbers within the Planning Area continue to increase, and with this comes a greater risk of disturbance to native plant communities and special status species. Activities such as seed collection have become more popular as the demand for drought-tolerant plants increases. Recreationists are seeking new areas, as well as continuing to visit popular destinations, which exposes new areas to disturbance and increases the chance for outbreaks of undesirable plants.

Controlling undesirable and non-native species is one of the most difficult challenges, as well as one of the most significant problems, facing vegetation managers. To control weeds on BLM land, the BLM along with Grand and San Juan Counties are utilizing integrated pest management strategies (combined use of mechanical, cultural, chemical, manual, biological, and prevention measures).

Table 3-31. Noxious and Invasive Species of Grand County and San Juan County, Utah

Common Name	Scientific Name
Bermudagrass	*Cynodon dactylon*
Black henbane	*Hysocyamus niger*
Canada Thistle	*Cirsium arvense*
Camelthorn	*Alhagi pseudalhagi*
Cheatgrass	*Bromus tectorum*
Dalmatian toadflax	*Linaria dalmatica*
Diffuse Knapweed	*Centaurea diffusa*
Dyer's Woad	*Isatis tinctoria*
Field bindweed	*Convolvulus arvensis*
Halogeton	*Halogeton glomeratus*
Hog millet	*Panicum miliaceum*
Houndstongue	*Hyoscyamus niger*
Jointed goatgrass	*Aegilops cylindrical*
Johnson Grass	*Sorghum halepense*
Perennial Sorghum	*Sorghum almum*
Musk Thistle	*Carduus nutans*
Poison hemlock	*Conium maculatum*
Perennial Pepperwood/Whitetop	*Lepidium latifolium*
Phragmites (Common Reed)	*Phragmites australius subspecies australius*
Puncturevine	*Tribullus terrestris*
Purple loosestrife	*Lythrum salicaria*
Quackgrass	*Elytrigia repens*

Common Name	Scientific Name
Russian Knapweed	*Centarea repens*
Russian Olive	*Elaeagnus angustifolia*
Russian thistle	*Salsola tragus*
Salt-cedar	*Tamarix chinensis*
Scotch Thistle	*Onopordium acanthium*
Spotted Knapweed	*Centaurea maculosa*
Squarerose Knapweed	*Centaurea squarrosa*
Whitetop/Hoary cress	*Cardaria spp.*
Yellow nutsedge	*Cypreus esculentus*
Yellow toadflax	*Linaria vulgaris*

Weed eradication methods, such as herbicide spraying, must be consistent with the Final EIS and Record of Decision (Utah section) for *Vegetation Treatment on BLM Lands in Thirteen Western States* (BLM 1991b) and the *Final Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States Programmatic EIS* (BLM 2007). The use of certified weed-free hay is one guideline implemented from Utah BLM Health Standards and Guidelines for Healthy Rangelands to control the spread of noxious weeds (BLM 1997). For revegetation purposes, the use and perpetuation of native species is a priority,-except for certain situations where non-native species may be desirable.

3.18 VISUAL RESOURCE MANAGEMENT/AUDITORY MANAGEMENT (SOUNDSCAPES)

3.18.1 Resource Overview

Visual Resources

BLM's visual resource management (VRM) system is a way to identify and evaluate scenic values to determine the appropriate levels of management. VRM is a tool to identify and map essential landscape settings to meet public preferences and recreational experiences today and into the future. BLM's VRM system helps to ensure that actions taken on the public lands will benefit the visual qualities associated with the landscapes while protecting these visual resources for adjacent communities in the future.

The Planning Area is an internationally recognized, world-famous scenic destination containing an unusually large number of areas that possess a high degree of scenic quality and a high level of visual sensitivity. The Planning Area draws an increasing number of visitors each year who come to the area to recreate and sightsee. In general, high scenic quality within the Planning Area is a product of the extraordinary topography, geology, and cultural history. Scenically diverse vistas and canyon river ways, rare and unusual geological formations, colorful and highly contrasting sandstones, and numerous prehistoric rock art and structures also contribute to the area's high visual quality. Areas with high visual sensitivity are the primary result of the high degree of visitor interest in and public concern for a particular area's visual resources, an area's high degree of public visibility, the level of use of an area by the public, and the type of visitor use that an area receives (BLM 1992).

In addition, much of the Planning Area borders two National Parks, Arches National Park and Canyonlands National Park. The views from these parks are often of the surrounding BLM lands. Dead Horse Point State Park, Utah's premier State park, is a platform from which to view the surrounding scenery, which is located largely on BLM lands.

The Planning Area and adjoining areas including Canyonlands National Park, Arches National Park, and Deadhorse Point State Park also are renowned for opportunities to view naturally dark night skies. These night skies are among the most unspoiled and spectacular remaining in the continental United States. In NPS management documents, naturally dark night skies are identified as important resources both in Canyonlands and Arches National Parks. In August 2015, the International Dark-Sky Association granted Gold-Tier International Dark Sky Park status to Canyonlands National Park, an honor reserved for the darkest of dark skies and the most stunning of starscapes. Opportunities to view and enjoy naturally dark night skies have become increasingly important to the recreational experiences of both BLM and Park visitors. This opportunity is often not possible in urban areas (Duriscoe et al. 2014).

The landscape within the Planning Area is being impacted by increases in recreation and tourism, vehicular travel, and the increasing numbers of sightseers attracted to the Planning Area. These increases have occurred primarily because of the extraordinary scenic qualities of the area. The tourist industry is also increasing as a result of increased recreational and vehicular use and an increase in visitors to Arches and Canyonlands National Parks who subsequently recreate on BLM-administered lands. Additionally, the area has experienced an increased demand by filming, commercial photography, and television commercial filming industries due in large part to the unique visual quality. The visual quality within the Planning Area is also being impacted by development of utility corridors, from minerals exploration and development, and from other land-use disturbances.

Natural Soundscapes

The natural soundscape is a resource that consists of the natural sounds that occur in a particular environmental setting, as well as the physical capacity for transmitting those natural sounds and their interrelationships with one another. The natural soundscape is a significant component of the recreational experience enjoyed by visitors to the Planning Area and adjacent lands. Like airsheds, viewsheds, and watersheds, soundscapes transcend management boundaries and are among the resource values that are shared between the Planning Area and surrounding landscapes. The National Park Service identifies the natural soundscape as an important resource in Canyonlands and Arches National Parks. Natural soundscapes in the Planning Area and adjacent lands can be impacted by noise generated by motorized recreation, mineral exploration and development, as well as other human activities. Noise propagation modeling based on geospatial grids of modeled ambient sound level data was performed by National Park Service in 2014 to determine the potential impacts of mineral operations on NPS soundscapes (Stanley and Miller 2015).

Current Management Practices

The BLM categorizes visual resources into four distinctive inventory classes, which are based on scenic quality evaluations, sensitivity level analysis, and the delineation of distance zones. These inventory classes are then filtered with current management objectives of all resource programs to create VRM classes, which determine the amount of change that is allowable to the basic elements of the landscape for development activities. The classes are as follows:

- **Class I** – The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention. Class I can only be applied to lands with a special designation, such as WSAs or ACECs.

- **Class II** – The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

- **Class III** – The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

- **Class IV** – The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The major areas within the Planning Area that possess both outstanding scenic quality and high visual sensitivity include, but are not limited to: Canyon Rims (encompassing the area from Harts Draw to Hurrah Pass); the Indian Creek Corridor; Lockhart Basin; Kane Creek; Wall Street; the Labyrinth Rims; Gemini Bridges; the Dead Horse Point/Shafer Trail area; Porcupine Rim; and the area around Mill and Tusher Canyons. Visually scenic and sensitive river areas include the segments of the Colorado River and Labyrinth Canyon (the Green River and its tributaries).

Areas of high scenic quality and visual sensitivity that are associated with travel corridors include the Kane Creek area (from U.S. 191 to its confluence with the Colorado River); the non-paved portion of the Potash Road (Shafer Basin) from Utah Highway 279 to the border with Canyonlands National Park; and the State Highway 313/Seven Mile Canyon/Monitor-Merrimac Buttes area. Other major scenic travel corridors within the Planning Area include U.S. 191 and State Highways 128, 211, 279, and 313, which have been designated as State Scenic Byways. In addition, the Needles Overlook and Anticline Overlook Roads, as well as the Lockhart Basin/Kane Creek roads, are designated as State Scenic Backways. The Planning Area also contains thousands of miles of OHV, bike, equestrian, and foot trails that are traveled as scenic routes, many of which are internationally recognized.

Much of the Planning Area is within the scenic viewsheds observed from adjoining Arches National Park, Canyonlands National Park, and Deadhorse Point State Park. Visitors to these parks experience iconic scenic vistas that are among the most spectacular in the country, and that often include expanses of BLM-administered lands located within the Planning Area. Scenic visual resources and values are among the purposes for which Canyonlands and Arches were established.

Current VRM classes by acreage in the Planning Area are shown on Table 3-32 and Map 3-62.

Table 3-32. VRM Classes and BLM Acreage in the Planning Area

VRM Class	BLM Acreage
VRM Class I	13,384
VRM Class II	324,721
VRM Class III	372,836
VRM Class IV	74,626

In 2011, the BLM conducted a visual resource inventory (VRI) which included lands within Planning Area in the Moab Field Office. The VRI process provides the BLM with a means for determining visual values. The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, lands are placed into one of four VRI classes. The inventory classes represent the relative values of the visual resources. Inventory Classes I and II identify areas with the most values, Inventory Class III represents a moderate value, and Inventory Class IV identifies those lands with the least value. Inventory Class I can only be applied to lands with a special designation, such as WSAs or ACECs.

The VRI included an assessment of viewsheds from Arches National Park. The area adjoining the Park on both the northern and eastern side of the Park was rated as VRI Class II based on scenic quality, the amount of use, and distance zones. The land beyond the VRI Class II area was rated low for scenery and sensitivity (amount of use and distance). The ratings were determined from key observation points within Arches National Park.

The inventory classes provide the basis for considering visual values during the RMP process and are the basis for determining the appropriate management prescriptions. While no current RMP management prescriptions apply to the new VRI, these data may be used during this planning process to assist the BLM in identifying appropriate mineral leasing stipulations to mitigate impacts on visual resources.

The resulting VRI classes and acreages in the Planning Area are presented in Table 3-33 and on Map 3-63.

Table 3-33. VRI Classes and BLM Acreage in the Planning Area

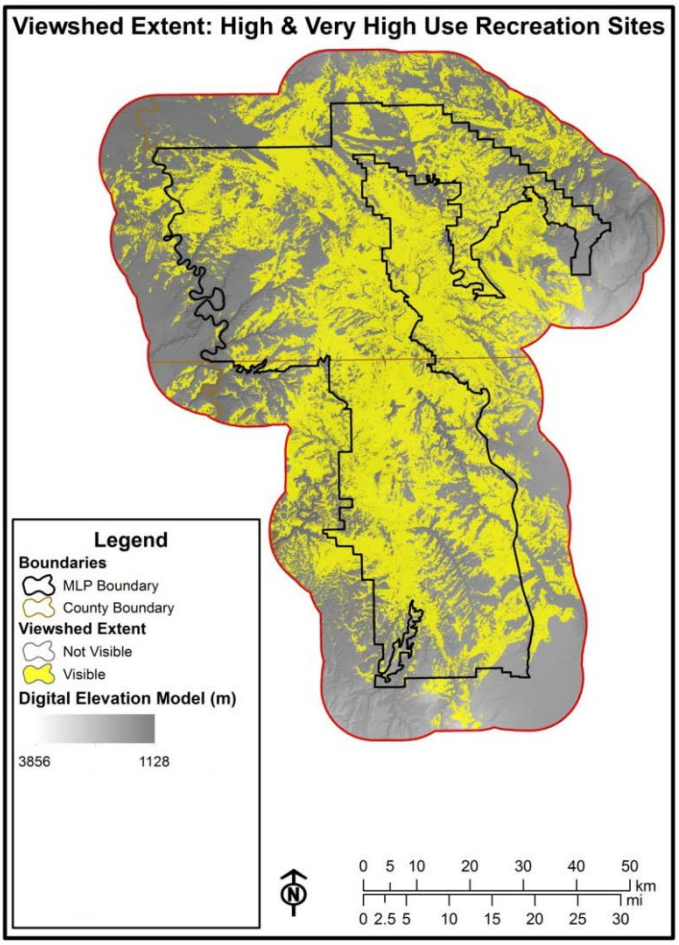
VRI Class	BLM Acreage
VRI Class I	90
VRI Class II	348,065
VRI Class III	144,093
VRI Class IV	89,376

Recreational Viewsheds[8]

As part of the current planning process, the BLM worked with the USGS to undertake an analysis of viewsheds most likely affected by recreation and minerals decisions. The resulting study identified those viewsheds within the Planning Area with the highest potential value for those recreationists for whom scenic qualities are an important part of their recreational experience. The BLM provided data on important view point locations (hiking trails, OHV trails, mountain biking trails, equestrian trails and developed viewpoints, including those located within neighboring NPS and State Park lands), along with estimates of usage (very high, high, medium, low). The study which USGS produced provided GIS data and maps for each of the resources described above, as well as out puts for high, medium and low use levels. Figure 3-6 depicts those areas within the Planning Area visible from high and very high use recreation sites.

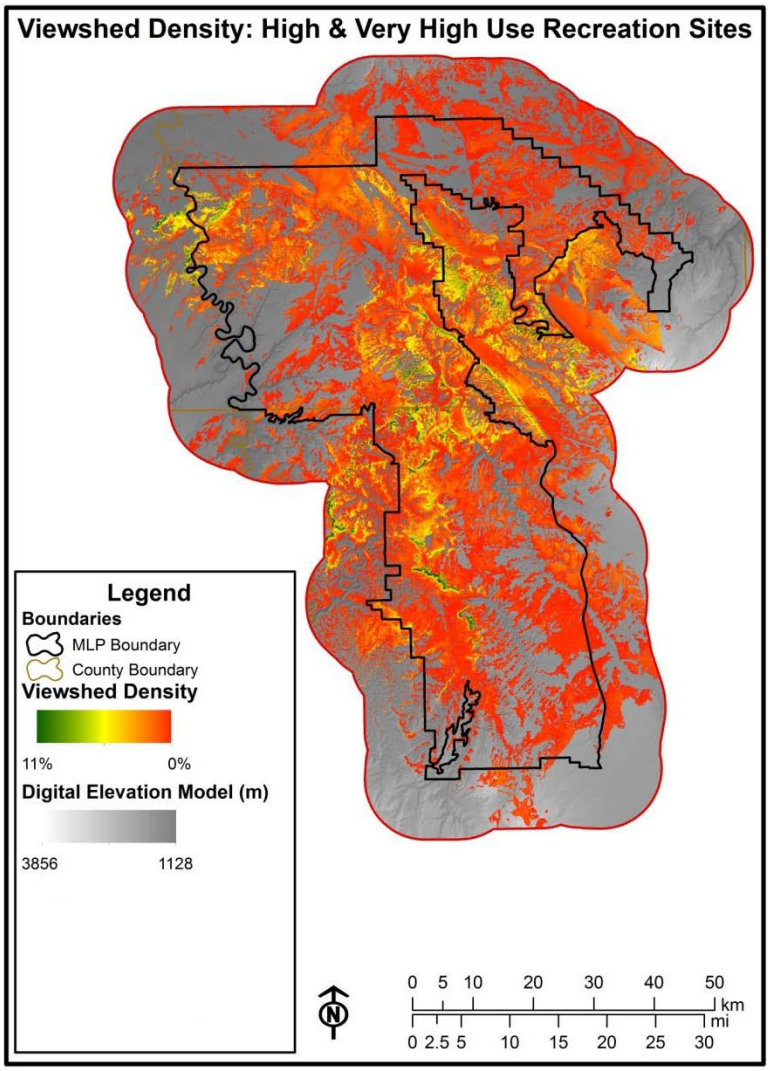
[8] *This abbreviated analysis and associated figures are derived from work done by Brian Voigt at the University of Vermont, under contract with USGS and BLM.*

Figure 3-6. Viewshed Extent: High and Very High Use Recreation Sites



Another output of the study is viewshed density. This is defined as the number of discrete locations from a specific point within the viewshed that are visible, and is depicted in Figure 3-7. High density (depicted in green) indicates that the particular area shown on the map is visible from more locations, while low density (depicted in red) indicates that the particular area on the map is visible from fewer locations.

Figure 3-7. Viewshed Density: High and Very High Use Recreation Sites



The above figures show that approximately 46 percent of the Planning Area is visible from one or more "High" or "Very High" use recreation locations.

3.19 WILDLIFE AND FISHERIES

3.19.1 Resource Overview

The Planning Area is in the heart of the Colorado Plateau and has a great amount of landscape diversity. This location produces a unique combination of landforms and habitat types. This diversity of habitat is reflected in the diversity of terrestrial and aquatic life that occurs within its borders.

Species in the Planning Area include big game species such as mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus nelsoni*), pronghorn (*Antilocapra americana*), desert bighorn sheep (*Ovis canadensis nelsoni*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*). Additional wildlife species of concern in the Planning Area fall within the general categories of upland game species, raptors, waterfowl, and shorebirds, fish and aquatic species, neotropical migrants and small mammals and reptiles. Management goals for most wildlife populations in the Planning Area are determined primarily by the UDWR, with the exception of the Federally protected wildlife populations, which are determined by the USFWS. The current RMP allocates forage for elk, deer, bighorn sheep, and antelope. Resource allocations for raptors, reptiles, amphibians, and other non-game species are limited to protecting individuals and the habitat of State and Federally listed species, and designating spatial and temporal barriers for nesting raptors.

The BLM's management of wildlife habitat has had, and will continue to have, an impact on both local communities and those that exist outside the Colorado Plateau. There is considerable regional interest in the overall condition and management of the Planning Area. In the past, a majority of the local interest has been focused on big-game management and associated recreational activities. In recent years, however, non-consumptive uses in the in the Planning Area, such as tourism and wildlife viewing have been increasing with the continued expansion of Utah's tourism industry. Because many of the wildlife species found in the Planning Area regularly cross public, private, and tribal lands, a collaborative effort between all land managers and owners has been essential for effective wildlife management in the Planning Area.

The Moab and Monticello BLM work closely with the UDWR to ensure that big game habitats identified by the UDWR are also fully recognized in planning efforts. The UDWR has compiled a list of its most current habitat delineations for many big games species that are located on the Utah Conservation Data Center: UDWR Index of Available GIS Data at http://dwrcdc.nr.utah.gov/ucdc/Download GIS/disclaim.htm.

The UDWR periodically reviews these habitat areas through coordination with the various land management agencies and updates these files as needed. The UDWR has various specific terms for a large variety of habitat types that the BLM uses to determine various management decisions. These various habitat types identified by the UDWR have been used by the BLM to identify the most crucial habitats that big game species need during sensitive periods, such as birthing and winter concentration periods. The habitats managed by the BLM often are selected by their importance (crucial vs substantial) and their season of use and have different names than the terminology that the UDWR has assigned to these various areas. Table 3-34 lists the names of UDWR habitats and their corresponding BLM terminology.

Table 3-34. Names of Utah Division of Wildlife Resources Habitats and their Corresponding BLM Habitat Names

UDWR Habitats	BLM Habitats
Deer	
Year Long Habitat – Substantial	Habitat

UDWR Habitats	BLM Habitats
Winter Habitat – Crucial	Crucial Winter Habitat
Winter Habitat – Substantial	Substantial Winter Habitat
Summer Range – Crucial	Fawning Grounds
Spring/Fall – Crucial	Fawning Grounds
Elk	
Year Long Habitat – Critical	Habitat
Winter Habitat – Crucial	Crucial Winter Habitat
Summer Range	Summer Habitat
Spring/Fall – Crucial	Calving Grounds
Pronghorn	
Year Long Habitat – Crucial	Fawning Habitat
Year Long Habitat – Substantial	Habitat
Desert Bighorn Sheep	
Year Long Habitat – Crucial	Habitat
Year Long – Substantial	Habitat
Lambing/Rutting	Lambing and Rutting Habitat

Big Game

The BLM works closely with the UDWR to ensure that big game habitats identified by the UDWR receive the needed management prescriptions. Within the Canyon Country district, much of the deer and elk habitat overlaps and management prescriptions are often the same for both species. Therefore, the acreages noted below in the Mule Deer and Rocky Mountain elk sections are not additive to those acreages shown in Chapter 2 because of the overlapping nature of these habitat areas.

Mule Deer (*Odocoileus hemionus*)

Mule deer occupy most ecosystems in Utah but likely attain their greatest densities in shrublands on areas characterized by rough, broken terrain and abundant browse and cover. In the Rocky Mountains, winter diets of mule deer consist of approximately 75 percent browse from a variety of trees and shrubs and 15 percent forbs. Grasses make up the remaining ten percent of the diet during winter. In the spring, browse is 49 percent of the diet and grasses and forbs make up approximately 25 percent each. Summer diets are 50 percent browse, with forbs consumption increasing to 46 percent. Browse use increases again in the fall to approximately 60 percent of the mule deer diet, forb use declines to 30 percent, and grasses increase to ten percent (Fitzgerald et al. 1994). Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks located at higher elevations. Winter range habitat primarily consists of shrub-covered, south-facing slopes and often coincides with areas of concentrated human use and occupation. Winter range is often considered a limiting factor for mule deer in the Intermountain West. The portions of these habitats managed by the BLM are listed in Table 3-35 and identified in Map 3-64.

Table 3-35. Mule Deer Habitat Managed by the BLM within the Planning Area

Habitat Type	Acres (Moab Field Office)	Acres (Monticello Field Office)	Acres* (Planning Area)
Habitat	18,600	None	18,600
Crucial Winter Habitat	30,289	95,706	125,995
Substantial Winter Habitat	0	8,630	8,630
Fawning Grounds	26	8,328	8,354

*These acreages are only for the Planning Area and are derived from Utah Conservation Data Center – UDWR Mammal Habitat Coverages (UDWR 2012a)

Because of learned behavioral use patterns passed on from one generation to the next, deer migrate for the winter into the same areas every year, regardless of forage availability or condition. These generally are areas with shallow snow depth, which allow easier movement, with pinion-juniper and sagebrush vegetation types. These vegetation types provide deer with both escape and thermal cover. Sagebrush is their primary forage during the winter season.

The management goals for mule deer populations in the Planning Area are to provide a broad range of recreational opportunities, including hunting and viewing; balance mule deer herd impacts with human needs, such as private property rights, agricultural crops, and local economies; and maintain the mule deer population at a level that is within the long-term capability of the available habitat. The target wintering mule deer herd size and annual harvest as well as current mule deer number estimates for the wildlife management units associated with the Planning Area are described in Table 3-36. The deer in the Dolores subunit migrate onto this unit and are also hunted in Colorado, but Colorado figures are not known. The harvest figures are generally low for Utah because the deer are typically in Colorado at the time of the Utah deer hunting season.

Table 3-36. Utah Division of Wildlife Resources Current Mule Deer Estimates

Unit Number	Unit Name (subunit)	Postseason Bucks/100 Does Objective**	Classification % Bucks ≥ 3 Points	Population Estimate (# animals)*	Population Objective	Percent Objective	Current Buck/Doe Ratio**	2012 Harvest**
13a	La Sal (La Sal Mountains)	11	40%	8,900	18,100	49%	11/100 22/100	587
13b	La Sal (Dolores Triangle)	22	67%					10
14a	San Juan (Abajo Mountains)	14	33%	9,100	20,500	44%	14/100 24/100	873

Unit Number	Unit Name (subunit)	Postseason Bucks/100 Does Objective**	Classification % Bucks ≥ 3 Points	Population Estimate (# animals)*	Population Objective	Percent Objective	Current Buck/Doe Ratio**	2012 Harvest**
14b	San Juan (Elk Ridge)	24	80%					43
13 & 14	Planning Area	18	55%	18,000	38,600	47 %	18/100	1,513

*2010 Antlerless Deer Permit Summary and Recommendations
**UDWR 2012b

Mule deer trends in Utah over the past several decades have been highly variable. Mule deer population crashed following several years of drought and an unusually hard winter (1992 to 1993). Since then mule deer trends State-wide have on average be increasing (UDWR 2008, UDWR 2007b). Over the past five years fawn production has been poor and the overall deer population has been declining in the Planning Area leading to a population estimate that is well below the UDWR current objective (Table 3-37). Poor range conditions caused by severe drought could be a major factor causing the population decline (UDWR 2005b). Predation, while not within BLM's jurisdiction, can also contribute to deer population declines.

Table 3-37. Mule Deer Population Trends

Unit Number	Unit Name (subunit)	Current Objectives	2006 Winter Population Estimate	2007 Winter Population Estimate	2008 Winter Population Estimate	2009 Winter Population Estimate	2010 Winter Population Estimate	2011 Winter Population Estimate	2012 Winter Population Estimate	Trend
13	La Sal	18,100	10,850	11,100	7,400	7,800	6,600	7,200	8,900	Declining
14	San Juan	20,500	13,700	15,400	12,800	16,400	12,900	13,200	9,100	Declining
13 & 14	La Sal and San Juan	38,600	24,550	26,500	20,200	24,200	19,500	20,400	18,000	Declining

Source: UDWR 2012

Rocky Mountain Elk (*Cervus elaphus nelsoni*)

The Rocky Mountain elk is considered a generalist feeder (Fitzgerald et al. 1994). Grasses and shrubs compose most of the winter diet, with the former being of primary importance in the spring months (Kufeld 1973). Forbs become increasingly important in late spring and summer, and grasses again dominate in the fall. These feeding relationships may change somewhat, depending on location. Associated with seasonal changes in diet are seasonal changes in habitat. The season and function of use of these habitats help

distinguish various types of winter ranges, production areas (calving grounds), and/or summer range. Production or calving areas are used from mid-May through June and typically occupy higher elevation sites than winter range. Calving grounds are usually characterized by aspen, montane coniferous forest, grassland/meadow, and mountain brush habitats, and are generally in locations where cover, forage, and water are in close proximity (Fitzgerald et al. 1994). In western Colorado, for instance, most females calve within 660 feet of water (Seidel 1977). Winter range is often considered a limiting factor for Rocky Mountain elk in the Intermountain West. Typical Rocky Mountain elk winter range occurs between 5,500 and 7,500 feet elevation and comprises mountain shrub and sagebrush habitats. Crucial winter range is considered to be the part of the local deer and/or elk range where approximately 90 percent of the local population is located. The middle and higher elevations of the Planning Area sustain several large Rocky Mountain elk populations.

The portions of these habitats managed by the BLM are listed in Table 3-38 and identified in Map 3-64.

Table 3-38. Rocky Mountain Elk Habitat Managed by the BLM within the Planning Area

Habitat Type	Acres (Moab Field Office)	Acres (Monticello Field Office)	Acres (Planning Area)*
Habitat	None	5,766	5,766
Crucial Winter Habitat	None	18,050	18,050
Calving Grounds	None	152	152

*These acreages are only for the Planning Area.

Rocky Mountain elk populations are associated with the four wildlife management subunits found in the Planning Area. The management goals for Rocky Mountain elk populations are to provide a broad range of recreational opportunities, including hunting and viewing; to balance elk herd impacts with human needs, such as private property rights, agricultural crops, and local economies; and to maintain the elk population at a level that is within the long-term capability of the available habitat. Rocky Mountain elk objectives and population estimates for the Planning Area are displayed in Table 3-39.

Table 3-39. Utah Division of Wildlife Resources Current Rocky Mountain Elk Objectives and Population Estimates

Unit Number	Unit name subunit	Winter Population Objective (# animals)*	Age Objective**	Winter Population Estimate (# animals)*	Percent of Objective	Current Bull/Cow Ratio (2010)	2012 Harvest**
13a	La Sal (La Sal Mountains)	2,500	5.5-6.0	2,300	92%	39/100	288
13b	La Sal (Dolores Triangle)		5.5-6.0			23/100	25
14a	San Juan (Montezuma Canyon)	1,300	7.5-8.0	1,300	100%	70/100	155
14b	San Juan (Elk Ridge)						232
13 & 14	Planning Area	3,800	6.2-6.7	3,600	95%	44/100	599

Unit Number	Unit name subunit	Winter Population Objective (# animals)*	Age Objective**	Winter Population Estimate (# animals)*	Percent of Objective	Current Bull/Cow Ratio (2010)	2012 Harvest**

*Antlerless Elk Permit Summary and Recommendations.
**UDWR 2010
***Elk Management Plan
****This number comprises Abajo Mountains and Montezuma Canyon

A majority of the elk in the La Sal wildlife management unit stay on private and USFS lands year-round; however, BLM lands do provide some winter range; these BLM lands include Hatch Point and Harts Point. Rocky Mountain elk population trends for the past seven years have been relatively stable (Table 3-40). Although there has been variability between years overall the population is stable and near UDWR population objectives.

Table 3-40. Rocky Mountain Elk Population Trends

Unit Number	Unit name subunit	Population Objective	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Trend
13	La Sal	2,500	2,650	2,600	1,970	1,900	2,100	2,500	2,300	2,500	2,400	2,300	Stable
14	San Juan	1,300	1,130	1,140	1,350	1,400	1,100	1,400	1,400	1,600	1.500	1,300	Stable
13 & 14	All Units	3,800	3,780	3,740	3,320	3,300	3,200	3,900	3,700	4,100	3,900	3,600	Stable

Source: UDWR 2010

Black Bear (*Ursus americanus*)

In the Intermountain West, black bears are typically associated with forested or brushy mountain environments and wooded riparian corridors. They seldom use open habitats (Zeveloff and Collett 1988). Black bears tend to be nocturnal and crepuscular and are considered omnivorous. Preferred foods include berries, honey, fish, rodents, birds and bird eggs, insects, and nuts. Black bears obtain most of their meat from carrion. From November to April, bears enter a period of winter dormancy. Winter dens are located in caves, under rocks, or beneath the roots of large trees where they are kept nourished and insulated by a several-inch-thick layer of fat (Zeveloff and Collett 1988).

A black bear management plan for the State of Utah was completed by the UDWR in 2000. This plan outlines the historic and current management of black bears in the State. With respect to black bears, the goal of the wildlife management units in the Planning Area is to maintain a healthy bear population capable of providing a broad range of recreational opportunities (including hunting and viewing in existing occupied habitat) while considering human safety, economic concerns, and other wildlife species. The management

objectives are to maintain bear distribution and increase it in suitable unoccupied or low density areas; maintain current bear populations with a reasonable proportion of older age animals and breeding females; balance bear population numbers with other wildlife species; minimize the loss in quality and quantity of UDWR-identified, crucial and high-priority bear habitat, including migration corridors between occupied areas; reduce the risk of loss of human life and reduce chances of injury to humans by bears; reduce the number of livestock killed by bears; and maintain quality consumptive and non-consumptive recreational opportunities (UDWR 2000).

The middle and higher elevations of the Planning Area sustain several large black bear populations. Total acreage of black bear habitat in the Planning Area is unknown but black bear populations tend to mimic prey species trends as well as plant habitat health.

Pronghorn (*Antilocarpa americana*)

Pronghorn can be found throughout the western U.S., Canada, and northern Mexico. They are generally associated with open plains where they feed mainly on forbs and grasses. Pronghorn prefer to occupy areas with large tracts of flat to rolling open terrain where they rely on keen eyesight and swift movement to avoid predators. They also rely on vegetation within the shrub and grassland plant communities for food. Pronghorn are often found in small groups and are usually most active during the day.

The Planning Area contains a total of 253,292 acres of BLM pronghorn habitat (Table 3-41 and Map 3-65). The two pronghorn herds within the Planning Area are the San Juan Hatch Point herd and the La Sal South Cisco Desert herd.

Table 3-41. Pronghorn Habitat Managed by the BLM within the Planning Area

Habitat Type	Acres (Moab Field Office)	Acres (Monticello Field Office)	Acres (Planning Area)*
Fawning Habitat San Juan Hatch Point herd	72,075	27,669	99,744
Habitat La Sal South Cisco Desert herd	153,548	0	153,548

*These acreages are only for the Planning Area and are derived from Utah Conservation Data Center – UDWR Mammal habitat coverages (2014).

In 1971,172 pronghorn were reintroduced to the Hatch Point area. The population appeared to increase for the first three years following their introduction, but has declined since 1975. Drought, severe winter weather, and predation could be factors in the depletion of this herd.

The current La Sal South Cisco Desert pronghorn herd originated from 48 animals that were released in Colorado in 1968. In 1983 an additional 150 pronghorn were released. This increased the herd to approximately 250 animals. In 1988, Colorado Division of Wildlife released another 90 pronghorn near the Utah-Colorado State line. The Cisco pronghorn have expanded west and are sometimes seen near Green River and south of I-70. The herd had increased to approximately 1,000 animals by 1999. However, pronghorn are responsive to climatic conditions and while mild winters and good moisture conditions prevailed, pronghorn numbers increased, and their range expanded. During drought cycles, such as currently being experienced, pronghorn numbers sharply decline. The Cisco herd is currently believed to comprise less than 300 animals according to UDWR aerial counts conducted in 2010. The 5-year trend data (2008) for both herds show them to be increasing (La Sal) and stable (San Juan) although the 10-year

trend data shows the San Juan herd to be decreasing in the long term (Table 3-42). Aerial counts from 2009 and 2010 indicate that the herds may be declining. A pronghorn management plan for the State of Utah is currently being developed by the UDWR. This plan will outline the historic and current management of pronghorn in the State as well as the management goals and objectives for pronghorn populations in the State. Table 3-43 outlines the UDWR's current management goals for pronghorn and actual counts.

Table 3-42. Utah Division of Wildlife Resources Pronghorn Wildlife Management Estimates and Trends

Unit Number	Unit Name	Population Estimate*	5 Year Trend	10 Year Trend
13	La Sal (South Cisco)	125	Increasing	Increasing
14	San Juan (Hatch Point)	175	Stable	Decreasing
13 & 14	Planning Area	300	NA	NA

Source: UDWR 2010
*The Population Estimate is Different than the Population Counts shown in Table 3-43.

Table 3-43. Utah Division of Wildlife Resources Pronghorn Wildlife Management Goals, Counts, and Trends

Unit Number	Unit Name	Population Counts*	Bucks*	Does*	Population Objective**	Buck/Doe Ration*	2010 Harvest*
13	La Sal (South Cisco)	99	26	99	250	39/100	4
14	San Juan (Hatch Point)	106	17	89	300	23/100	2
13 & 14	Planning Area	205	42	188	550	NA	6

* Utah Annual Big Game Report 2012
**UDWR Pronghorn Management Unit Plans 2010
Source: UDWR 2012b

Desert Bighorn Sheep (*Ovis canadensis nelson*)

Desert bighorn sheep are uniquely adapted to inhabit some of the most remote and rugged parts of the Planning Area. Desert bighorns are sometimes referred to as a wilderness species because of the steep rocky areas they occupy for escape and safety. Habitat is characterized by rugged terrain including canyons, gulches, talus cliffs, steep slopes, mountaintops, and river benches (Shakleton et al. 1999). Desert bighorn generally occur in Southern Utah and do not migrate. Desert bighorn habitat acreages managed by the BLM within the Planning Area are listed in Table 3-44 and identified in Map 3-66.

Table 3-44. Desert Bighorn Sheep Habitat Managed by the BLM within the Planning Area

Habitat Type	Acres (Moab Field Office)	Acres (Monticello Field Office)	Acres (Planning Area)*
Habitat -	201,204	55,798	257,002
Lambing/Rutting Habitat	107,220	0	107,220

*These acreages are only for the Planning Area.

There are five herd areas for desert bighorn sheep in the Planning Area. The herd areas are 1) La Sal 2) La Sal Potash, 3) La Sal Professor Valley, 4) San Juan Lockhart, and 5) San Juan North.

The La Sal Potash and San Juan Lockhart bighorn herds, both adjacent to Canyonlands National Park, are one of the only remaining native (not transplanted or reintroduced) desert bighorn herds in Utah. This herd supports a viable population and is often used for reintroductions and augmentations throughout the Western U.S.

Data collected from 2002 through 2011 during three 2-year GPS collaring projects and over two years of collaboration between the Moab BLM biologist, UDWR and Canyonlands biologist, additional modeling and closer examination of the six years of GPS data have resulted in the development of a more accurate lambing and rutting grounds habitat delineation within the Moab Field Office that is now housed on the UDWR Conservation Data Center.

The habitat of the La Sal Professor Valley herd extends to the east of Arches National Park on BLM managed lands in the Cache Valley and Dome Plateau area. This area is located north of the Colorado River.

A State of Utah management plan for desert bighorn sheep was developed in 2013. This plan assesses current information on bighorn sheep, identifies issues and concerns relating to bighorn sheep management, and establishes goals and objectives for future bighorn management programs in Utah.

Table 3-45 outlines the current desert bighorn sheep estimates in the Planning Area and the wildlife management goals for desert bighorn sheep in the Planning Area. Overall herd populations have either a stable or decreasing population trend within the Planning Area (Table 3-46). Bighorn sheep require separation from domestic sheep to prevent the transmission of diseases against which they have no natural defenses. Water and vegetation improvements have also been shown to benefit bighorn sheep populations.

Table 3-45. Utah Division of Wildlife Resources Current Desert Bighorn Sheep Estimates in the Planning Area

Unit Number	Unit Name (subunit)	Population Count*	Population Objective**	Percent of Objective	Current Rams/ Ewes**	2012 Harvest***
13	La Sal (Potash)	69	300	23%	51/100	3
13	La Sal (Professor Valley)	25***	100	25%	NA	NA
14	San Juan (Lockhart)	40	200	20%	52/100	1
14	San Juan (North)	13	100	13%	45/100	NA
14	San Juan (South)	39	300	13%	40/100	2
	Planning Area	186	1,100	17%	NA	6

Unit Number	Unit Name (subunit)	Population Count*	Population Objective**	Percent of Objective	Current Rams/ Ewes**	2012 Harvest***

*UDWR 2013
**UDWR 2000
***UDWR 2012c
Source: UDWR 2007b

Table 3-46. Desert Bighorn Sheep Trends within the Planning Area

Unit Number	Unit Name (subunit)	Population Count	Trend	Herd Status
13	La Sal (Potash)	69	Decreasing	Native
13	La Sal (Professor Valley)	25*	Stable	Transplanted
14	San Juan (Lockhart)	40	Decreasing	Native
14	San Juan (North)	13	Decreasing	Native
14	San Juan (South)	39	Decreasing	Native
	Planning Area	186	Decreasing	Native or Transplanted

Source: UDWR 2013
*UDWR State Wide Management Plan for Bighorn Sheep 2008

Mountain Lion (Cougar) (*Puma concolor*)

The mountain lion, or cougar, likely inhabits most ecosystems in Utah. However, it is most common in the rough, broken terrain of foothills and canyons, often in association with montane forests, shrublands, and pinyon-juniper woodlands (Fitzgerald et al. 1994).

UDWR manages mountain lion population throughout the State. Trends from 1997-2008 indicate a stable population (UDWR 2011). Mule deer is the mountain lion's preferred prey species. Consequently, mountain lion seasonal use ranges as well as trends are likely to closely parallel those of mule deer.

Upland Game

Upland game in the Planning Area includes populations of blue grouse (*Dendragapus obscurus*), chukar partridge (*Alectoris chukar*), Rio Grande turkey (*Meleagris gallopavo*), and Gambel's quail (*Callipepla gambelii*). Annual fluctuations for most upland game bird and small mammal populations very closely correlate with annual climatic patterns. Mild winters and early spring precipitation during the months of March, April, and May are associated with increases in upland game populations. Warm, dry weather, especially during June, is generally considered vital for the survival of newly born young of many upland game species. On a large scale, the overall level of human disturbance is relatively high. Furthermore, the ongoing severe drought of recent years has contributed substantially to habitat deterioration. Population levels and trends for upland species typically mimic habitat quality.

Raptors

Special habitat needs for raptors include nest sites, foraging areas, and roosting or resting sites. Buffer zones developed in coordination with USFWS (Appendix E), are usually recommended around raptor nest

sites during the early spring and summer when raptors are raising their young. The most utilized raptor nesting habitats in the Planning Area are generally found along riparian areas and cliff faces. Juniper-desert shrub transition areas are identified as being important for nesting ferruginous hawks (*Buteo regalis*). Bald eagles use the Planning Area extensively for winter foraging. The golden eagle (*Aquila chrysaetos*), and peregrine falcon (*Falco peregrinus*) are representative guild species for cliff rock habitat. The ferruginous hawk (*Buteo regalis*) and burrowing owl (*Athene canicularia*) are representative guild species for grassland habitat. The ferruginous hawk is also a representative guild species for desert scrub habitat. Impacts to these species can be partly assessed through the impact to these habitat types. Cooper's hawk (*Accipiter cooperii)* prefer woodland areas and riparian zones. Though populations of this hawk were once declining, they have recently stabilized, and are even increasing in some areas. Sharp-shinned hawks (*Accipiter striatus*) prefer forest and woodland habitats, often nesting in coniferous forests. Northern populations migrate south for the winter, but some sharp-shinned hawks are year-round residents of the same area. The species is common throughout the year State-wide in Utah. The northern harrier (*Circus cyaneus*) is a year-round resident of Utah, where it can be found in open habitats such as marshes, fields, and grasslands. Individuals may congregate into roosting colonies during the winter in areas where food is abundant. Red-tailed hawks (*Buteo jamaicensis*) are frequently found in open country where scattered trees or other elevated perches are available for nesting high in trees, frequently in the tallest tree near the edge of woods, sometimes as high as 100 feet above ground and cliff faces. American kestrels (*Falco sparverius*) are usually found in open habitats, such as prairies, deserts, wooded streams, and farmlands.

Throughout the western region of the U.S. raptor population trends have tended to be stable to decreasing for most species, due to habitat loss and drought (Raptor Population Index 2011).

Waterfowl

Waterfowl in the Planning Area are generally associated with the Colorado River and its drainages. Some waterfowl can also be found in other riparian areas, such as ponds, reservoirs, and perennial streams. Some individuals or species breed, winter, or remain yearlong in the State, while larger numbers pass through the area during the spring and fall migration. Many species feed on insects and small fish or amphibians in addition to aquatic plant foods. In addition, some species feed frequently on upland grasses and forbs in grassy fields and meadows where such vegetation is succulent and habitat is sufficiently open to preclude hiding predators and enable rapid flight. Within the Planning Area, the most important areas for waterfowl are the Colorado River, the Green River and the Indian Creek corridor.

Waterfowl population trends generally throughout the Planning Area and Region are stable to increasing (Sauer et al. 2012). Blue-winged teal was the only species that was considered to have a decreasing trend in population (Sauer et al. 2012).

Neotropical Migratory Birds

There are a wide variety of songbirds and neo-tropical migrants which spend at least part of the year within the Planning Area (Parrish et al. 2002). These species utilize a wide variety of habitats found within the Planning Area. Special habitat needs for migratory birds include nest sites and foraging areas.

A variety of migratory bird species use habitats within the Planning Area for breeding, nesting, and foraging. Migratory birds may nest on tree limbs, on the ground, or in/on rock outcrops. The nesting season for migratory birds is generally May 1st through July 31st. Raptor nest sites are typically located on promontory points such as cliff faces and rock outcrops in areas with slopes of 30 percent or greater, but they may also nest in pinyon, juniper, or deciduous trees. Raptors typically use the same nest site year after year. Nesting and fledgling seasons for raptors vary but typically extend from March 1st through August 31st or slightly longer than for migratory birds generally. The Planning Area also offers suitable wintering and migration habitats for non-nesting raptor species. The USFWS issued guidelines for the protection of

raptors that includes species-specific timing limitations and spatial offsets to active nests (Romin and Muck 2002).

Migratory birds are protected under the MBTA. The MBTA makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. Some birds are also protected by the ESA, the Bald and Golden Eagle Protection Act, and/or are included in the State of Utah/BLM Sensitive Species Lists. The Bald and Golden Eagle Protection Act, which initially protected only bald eagles, was amended in 1962 to include the golden eagle because of its dwindling populations and similar appearance to bald eagles when both eagles are young. The act prohibits anyone from "taking" eagles, including their parts, nests, or eggs without a permit issued by the Secretary of the Interior. A taking also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

To further the purposes of these protective acts, Memorandum of Understanding WO-230-2010-04, *To Promote the Conservation of Migratory Birds*, was issued in 2010 by the BLM and the USFWS. Identifying wildlife species of concern, priority habitats, and key risk factors includes identifying species listed on the USFWS Birds of Conservation Concern (BCC) that are most likely to be present in the project area and evaluating and considering management objectives and recommendations for migratory birds resulting from comprehensive planning efforts, such Utah Partners in Flight (PIF) American Landbird Conservation Plan. The Utah PIF Working Group completed a statewide avian conservation strategy identifying "priority species" for conservation due to declining abundance distribution, or vulnerability to various local and/or range-wide risk factors. One application of the strategy and priority list is to give these birds specific consideration when analyzing effects of proposed management actions and to implement recommended conservation measures where appropriate.

The Utah PIF Priority Species List, the BCC list for Region 16 (Colorado Plateau), and the Utah Conservation Data Center database were used to identify potential habitat for priority species that could utilize habitats within the Planning Area. Table 3-47 lists the BCC and PIF species that may occur within the Planning Area.

Table 3-47. Birds of Conservation Concern Region 16 and Utah Partners in Flight High Priority Species That May Occur in Planning Area

Species	BCC§	UPIF(1)	UDWR Habitats(2)	1st Breeding Habitat(1)	2nd Breeding Habitat(1)	Winter Habitat(1)
Black Rosy-finch	X	X	Substantial/ Critical	Alpine	Alpine	Migrant
Black-throated Gray Warbler		X	Prime Breeding	Pinyon-Juniper Woodland	Mountain Scrub	Migrant
Bobolink		X	Prime Breeding/Winter	Wet Meadow	Agriculture	High Desert Scrub
Brewer's Sparrow	X	X	Critical/High	Shrub steppe	High Desert Scrub	Migrant
Broad-tailed Hummingbird		X	High/ Substantial	Lowland Riparian	Mountain Riparian	Migrant
Burrowing Owl	X		Primary Breeding	High Desert Scrub	Grassland	Migrant

Species	BCC§	UPIF[(1)]	UDWR Habitats[(2)]	1st Breeding Habitat[(1)]	2nd Breeding Habitat[(1)]	Winter Habitat[(1)]
Gambel's Quail		X	High	Low Desert Scrub	Lowland Riparian	Low Desert Scrub
Golden Eagle	X		High	Cliff	High Desert Scrub	High Desert Scrub
Grace's Warbler	X		Critical	Ponderosa pine	Mixed conifer	Migrant
Gray Vireo	X	X	Prime Breeding/Winter	Pinyon-Juniper Woodland	Oak	Migrant
Juniper Titmouse	X		Critical/High	Pinyon-Juniper Woodland	Pinyon-Juniper Woodland	Pinyon-Juniper Woodland
Long-billed Curlew	X	X	Substantial/Prime Breeding	Grassland	Agriculture	Migrant
Peregrine Falcon	X		Prime Breeding	Cliff	Lowland Riparian	Wetlands
Pinyon Jay	X		Critical/High	Pinyon-Juniper Woodland	Ponderosa pine	Pinyon-Juniper Woodland
Prairie Falcon	X		Critical/High	Cliff	High Desert Scrub	Agriculture
Sage Sparrow		X	Critical	Shrub steppe	High Desert Scrub	Low Desert Scrub
Virginia's Warbler		X	Winter	Oak	Pinyon-Juniper Woodland	Migrant

[(1)]Utah Partners in Flight Avian Conservation Strategy Version 2.0 (Parrish et al. 2002), §Birds of Conservation Concern 2008 (USFWS 2008)
†Utah Conservation Data Center, *Utah Sensitive Species,**=Federally List,
Italic=Utah Sensitive Species

Most of the bird species (especially neo-tropical) are decreasing in numbers throughout their ranges. According to Parrish et al. (2002), riparian habitats are used as either breeding or wintering habitat by Utah's birds almost twice as much as any other habitat type. Within Utah, 66 to 75 percent of all bird species use riparian habitats during some portion of their life cycle. Shrublands, forest, and additional habitat groups (e.g. water, rock, playa, agriculture, urban, and cliff) all are about equal and second to riparian when considering their importance to bird species. To prevent further population declines for bird species, the protection of these habitat types, especially riparian are crucial. Certain species can be followed more closely as indicators of overall ecosystem health. Both wildlife species of concern (PIF and BCC) and other species are discussed as indicators of ecosystem health.

Loggerhead shrike, habitat consists of open country with short vegetation. These habitats include areas such as pastures with fence rows, old orchards, mowed roadsides, cemeteries, golf courses, agricultural fields, riparian areas, and open woodlands. The loggerhead shrike is a small avian predator that hunts from perches and impales its prey on sharp objects such as thorns and barbed-wire fences. The Loggerhead shrike is one of the few North American passerines whose populations have declined continent wide in recent decades. Changes in human land-use practices, the spraying of biocides, and competition with

species that are more tolerant of human-induced changes appear to be major factors contributing to this decline.

The sage sparrow is a migrant that summers in Idaho and winters in Arizona, New Mexico and northern Mexico. It is found in sagebrush flats and desert shrub areas. It usually nests in sagebrush and typically feeds on insects and seeds. This species has been in recent decline. This decline is due to reduced, fragmented, and lost sagebrush steppe habitat that has resulted from increased wildland fires and cheatgrass invasion.

The sage thrasher's populations are mostly stable where suitable shrub-steppe habitat remains. However, its numbers have been dramatically reduced, and in some cases local populations have been eliminated where there has been wholesale conversion of sagebrush rangeland.

The Brewer's sparrow major habitat type is sagebrush shrublands. The Brewer's sparrow is by far the most abundant bird in sagebrush shrublands during spring and summer. Recent (1980s and 1990s) surveys (Rotenberry et al. 1999) have shown breeding numbers to be in significant decline throughout the species' range. The causes are uncertain, but they may be related to fundamental changes in shrubland ecosystems being brought about by agriculture, grazing, and the invasion of exotic plant species.

The warbling vireo occupies predominantly riparian habitat, but may also use a variety of other habitats including oak/mountain shrub and deciduous forest. It builds its nests in the forked limbs of trees from one to 40 meters (130 feet) above the ground at elevations ranging from sea level to over 3,000 meters (9,800 feet). The species appears well adapted to human landscapes, as nests have been found in neighborhoods, urban parks, orchards, and farm fencerows. However, its reproductive success in these areas has never been quantified.

The green-tailed towhee prefers species-rich shrub communities within shrub-steppe habitats and disturbed and open areas of montane forest, often created by wildland fires. The bulky nests of this species are concealed in shrubs but often are prone to predation. In winter, individuals are common in dense mesquite (*Prosopis* spp.) shrub habitat along desert washes. Breeding bird survey data suggest that populations have been stable overall since 1966, with no significant broad trends (Dobbs et al. 1998).

The juniper titmouse is a year-round resident of the pinyon-juniper woodland and pine woodlands; it is also common in suburbs. It nests in snag holes, both natural and made by woodpeckers. They typically feed on fruit, seeds, and insects. This species is generally tolerant of human encroachment.

The gray flycatcher is a migrant species that summers in Utah and Idaho and winters in Mexico. It nests in arid pinyon-juniper woodlands and sagebrush areas. It builds its nest in the crotch of juniper trees or sagebrush. It feeds exclusively on insects. This species is still quite common but faces the same risks that other sagebrush guild species face.

No known populations of yellow-billed cuckoo exist at present within the Planning Area (personal communication between Tammy Wallace, BLM, and Thomas Sharp, SWCA Environmental Consultants 2003). The yellow-billed cuckoo, however, is a neotropical migrant that utilizes riparian valleys throughout the State. The Western yellow-billed cuckoo is associated with cottonwoods and riparian cover, which provides nesting and brood-rearing habitat. Western yellow-billed cuckoos are obligate riparian nesters and are restricted to more mesic habitat along rivers, streams, and other wetlands. Yellow-billed cuckoos are discussed further under the sensitive species section of the document.

The Southwestern willow flycatcher utilizes and breeds in patchy to dense riparian habitats along streams and wetlands near or adjacent to surface water or saturated soils. These dense patches are often interspersed

with small openings, open water, and/or shorter/sparser vegetation, creating a mosaic habitat pattern. Population declines are attributed to numerous, complex, and interrelated factors such as habitat loss and modification, invasion of exotic plants into breeding habitat, brood parasitism by cowbirds, vulnerability of small population numbers, and winter and migration stress.

Song sparrows are relatively common in riparian habitat. They build open-cup nests near fresh water wherever suitable cover and insect food are present.

Spotted towhee breed in wide variety of plant associations, all characterized by dense, broadleaf shrubby growth (variously described as brush, thickets, or tangles). This shrubby growth is typically only a few meters tall, with or without emergent trees, and provides deep, sheltered, semi-shaded litter and humus on ground, and a screen of twigs and foliage close overhead.

Several of the migratory birds can be used as guild species for different wildlife habitat types. The loggerhead shrike is associated with desert shrub habitat, the sage sparrow, sage thrasher, and Brewer's sparrow are associated with sagebrush and perennial grassland, the warbling vireo, green-tailed towhee, and blue grouse are associated with oak mountain shrub habitat, the juniper titmouse, and gray flycatcher are associated with pinyon-juniper woodland habitat and yellow-billed cuckoo, Southwestern willow flycatcher, song sparrow, and spotted towhee are associated with riparian habitat. For the purposes of this analysis, impacts to these habitats will be used, in part, to assess impacts to these species. Unless stated above, the exact population status of all these species in the Planning Area is not known.

Reptile, Amphibian, and Other Non-Game Species

The Planning Area contains a high diversity of reptile, amphibian, and other non-game species, including small mammals, birds, and invertebrates, because of the variety of habitats found within the area. The Planning Area contains various riparian, talus slope, marsh, aspen-conifer, pinyon-juniper woodland, and ridgetop habitats that support these species. Very little is known about the status of most of these species, but an effort is being made to acquire basic information on those listed by State and Federal agencies as threatened and endangered species.

Riparian and Aquatic Species

The riparian and aquatic habitat in the Planning Area is associated with the Colorado River and tributaries. Riparian Species and Avian Riparian Species of Special Concern in the Planning Area include yellow-billed cuckoo (*Coccyzus americanus*) and southwestern willow flycatcher (*Empidonax traillii*) and the following four Federally endangered fish species: bonytail, Colorado pikeminnow, humpback chub, and razorback sucker Table 3-48 gives the current UDWR inventory of fisheries within the Planning Area.

Southwestern willow flycatcher potentially occurs within the Planning Area. It is currently believed that the range of this subspecies extends north to the Sand Wash area of the Green River (near the Uintah-Carbon County line). Many other threatened and endangered species are highly dependent on riparian areas, and they are also crucial to neo-tropical migrant birds. A primary concern with the riparian areas is the effect of decreased regeneration of cottonwood and willow stands and the invasion of non-native plant species such as salt cedar (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*) on riparian and aquatic wildlife species.

Table 3-48. Utah Division of Wildlife Resources Inventory of Fisheries within the Planning Area

River	Species
Colorado River	Colorado pikeminnow, humpback chub, bonytail, razorback sucker, flannelmouth sucker, blueheaded sucker, channel catfish, roundtail chub, speckled dace, Plains killifish, fathead minnow, red shiner, sand shiner, smallmouth bass, largemouth bass, carp, black bullhead, walleye
Green River	Colorado pikeminnow, humpback chub, bonytail, razorback sucker, flannelmouth sucker, blueheaded sucker, channel catfish, roundtail chub, speckled dace, fathead minnow, red shiner, sand shiner, smallmouth bass, largemouth bass, carp, black bullhead, yellow bullhead, walleye, northern pike
Kane Creek	Speckled dace, fathead minnow, red shiner, sand shiner, mosquitofish, plains killifish
Cottonwood Wash	Fathead minnow, red shiner, sand shiner